not have taken place many generations ago. On this account it is not possible to say whether the tree from which the germinated acorns were taken was the immediate product of the cross or whether it is the *n*th generation of its progeny.

In balanced crosses in which the parents show a large number of dissimilar characters the first generation rarely offers the spectacle of pure dominance of the characters derived from one parent and recessiveness of those from the other parent. It is only when the parents differ by a point or two that such total dominance is seen and the first generation or the immediate product of the cross resembles one parent or the other, and its progeny split in the next generation. In cases such as that under discussion, and which is also illustrated by the walnuts, the first generation shows a mixed dominance as well as a possible fractionization of some meristic qualities, so that the hybrid appears as an intermediate between the two parents, toward both of which its relative position may be variously estimated. In the second generation the movements of the recessives coupled with the range of fluctuating variability should give a wide diversity of types, varying in number with the number of differentiating points of the parents of the cross, which may include both parents, the type of the first generation, and an intricately interwoven connecting series of forms.

By reason of the number of dissimilar characters involved in such a cross the probability of deriving an individual composed entirely of recessive characters or of the particular combination characteristic of either ancestor is very small. A progeny of hundreds of thousands of species would be necessary to furnish a series inclusive of both ancestors and intermediate combinations.

While it may not be said that any of the plantlets of the progeny under observation are reconstituted ancestral forms, yet some of the individuals include so many of the qualities of the red oak and willow oak that the evidence is overwhelmingly in favor of the conclusion that the origin of *Q. heterophylla* is to be attributed to the hybridization of these two forms. Taking this conclusion as established, it may then be said that the name *Q. heterophylla* is at present applied to a medley of oak trees which possibly includes the first generation of a cross between *Q. rubra* and *Q. phellos*, secondary hybrids with either parent, as well as successive generations in which various combinations of ancestral qualities may appear.

Another aspect of the parental form of the above hybrid and the progeny remains to be mentioned. A collector covering the field occupied by the hybrid in which the parental forms come into contact, who gathered a full series of material from the trees available, would have data upon which mistaken conclusions as to intergradation of species by fluctuating variability might be made. This leads to the suggestion that any supposed intergradation of two species of seed plants should be examined with respect to possible hybridizations before any final estimate is reached in the matter.

Furthermore, it is to be seen that while in all reasonable probability opportunity for hybridization between these two oaks has been present for a period of unknown but undoubted great length, yet it has not resulted in anything in the way of occurrence or distribution suggestive of the disappearance of either parental form. The probably greater frequency of intra-specific fertilization over hybridization would secure this result. Then again it is to be seen that even in the case of complete cross fertilization of all of the individuals, there would be the probable reconstitution of the ancestral forms among the progenies.

Quercus Rudkini has long been reputed to be a hybrid between *Q. phellos* and *Q. Marylandica*, and a visit was made to the group of trees from which the species was originally described by Dr. Britton, in company with him and other botanists in October, 1905. These trees stand near Keyport, N. J., and since the original discovery in 1881 others have been found on Staten Island and also to some distance to the southwestward in New Jersey. The mere facts of distributional relations together with the anatomical features offered by the bark and leaves led to the description of these trees as being of a hybrid origin from the willow oak and the black oak. If these facts only are taken into account, it seems quite as plausible to regard this tree as a hybrid of *Q. heterophylla*. The leaves taken from the included trees showed a range of forms that included the type of *Q. phellos*, but did not go wide enough to show duplicates of those of the other parent as described and figured by Dr. Britton (Bull. Torr. Bot. Club, 9:13:1882). The acorns likewise ranged from the form near that of *Q. phellos* toward *Q. Marylandica*, but included none that might be mistaken for the latter. The bark of the various individuals on the other hand seemed most like *Q. Marylandica*, although much variation was apparent.

During the visit of 1905 acorns were found on trees of some of the types only, and material capable of germination was obtained from three of them. When these were at the end of the first year's growth, which began in the propagating houses in January in 1906 and ended in September, it was seen that the progenies of the three parents, selected for their dissimilarity, were fairly identical; and while a wide range of variability was found, yet this range did not exceed the limits of similar fluctuations offered by other species of oaks which are known to be unified hereditary strains.

The leaves of these seedlings did not include forms which might be mistaken for those of either parent. It is to be seen therefore that the cultural observations revealed no evidence to show that Rudkin's oak is of hybrid origin, although it did not disprove it. Synthetic tests, which take much time, and detailed anatomical examinations are yet to be resorted to. It is quite possible that the group of trees examined may represent some segregation of the ancestral qualities and not the full range of combinations discovered in *Q. heterophylla*. Meanwhile this oak, which is thus constant in successive generations within the limits of its variability, must be regarded as a species in accordance with current taxonomic practice, until some positive evidence to the contrary is obtained.

The principles illustrated by the foregoing facts may be briefly summarized as follows:

It is obvious that the facts of geographical distribution may be relied upon to furnish conclusive evidence as to the origin of a species or a hereditary quality only under very exceptional conditions in which other possibilities are excluded, and then only in a circumstantial manner. It is of course a basal and necessary fact that species not in contact may not hybridize, but the converse is true only when otherwise proven.

So far as the plants of suspected hybrid origin from parents suggested by distributional relations are concerned, the methods of investigation available are two, which may separately secure affirmative evidence of conclusive value, while the third may bring no more than confirmations and suggestions.

Attempts at synthesization, if successful, yield dependable conclusions as to the composition of a hybrid, yet a failure to secure a form by synthesis may be due to innate and almost intangible difficulties in the hybridization of the forms concerned, by the different results of reciprocal crossing and the difference in physiological attributes of elementary species included under one name. Furthermore, the natural form the ancestry of which is under search may have been a derived hybrid which became fixed in the *n*th generation by a fortuitous combination of dominant characters. To secure a similar result in an experimental test might be beyond the range of probability.

In an anatomical examination such a combination of dominant and recessive characters with fluctuations in meristic characters away beyond either parent may make the results of but little value until confirmed by data derived from other sources, before their full value may be known.

A study of a fixed hybrid by cultural tests of its progeny will reveal nothing as to its origin, and synthesization and anatomic examinations are the only recourse. On the other hand, if the progeny exhibits alternative inheritance, its components may show unmistakably the nature of the original cross.

The last-named method demonstrates beyond reasonable doubt that Bartram's oak is a hybrid derivative of the willow oak and red oak, the progeny being probably characterized by alternative inheritance of some of the qualities, and fractionization of others instead of being a unified hereditary strain. Some of the plantlets included in a progeny of 55 individuals were apparent re-constitutions of the ancestral types as observed at the close of the first year, while others were variously intermediate.

Rudkin's oak on the contrary yields no evidence in cultures of its progeny on which a defensible conclusion as to its origin may be based. The individual variability of the trees included under this name is very great, and some of these approach the willow oak in leaf form, and some of the characters of the acorns. The study of over a hundred plantlets showed a wide and practically identical range of variation. Alternative inheritance could not be traced. The individuals known under the name of *Q. Rudkini* produce a large proportion of imperfect acorns, but beyond this no facts suggestive of hybrid origin can be found, except the anatomical resemblances noted.

A list of the natural plant hybrids of North America was prepared by Mr. David George for presentation at the International Hybrid Conference in New York in 1902 but was not published. In this list it was noted that 117 natural hybrids had been reported as occurring in the indigenous flora of North America, in addition to some instances among the ferns and mosses. The manuscript having been placed at my disposal by the director of the New York Botanical Garden, a revision of the list has been made, some of the original references being omitted and a few added. No attempt has been made to make it actually complete, the sole purpose being to suggest material for extended observations similar to those described in this paper.

The reported hybrids are distributed among the natural families as follows:

- Naidaceæ. Two cases in *Potamogeton*.
- Cyperaceæ. Twelve hybrids in *Carex*.
- Juncaceæ. One hybrid, between *Juncus effusus* and *J. Pacificus*.
- Liliaceæ. One hybrid between *Calochortus Benthami* and *B. albus*.
- Orchidaceæ. One hybrid between *Habenaria lacera* and *H. psycodes*.
- Juglandaceæ. Three hybrids of *Hicoria pecan* with *H. minima*, *H. alba*, and *H. laciniata*.
- One hybrid between *Juglans nigra* and *J. cinerea*.
- Salicaceæ. About twenty supposed hybrids of *Salix* are noted.
- Two hybrids of *Betula* are also reported between *B. pumila* and *B. lenta* and between *B. populifolia* and *B. papyrifera*.
- Fagaceæ. Thirty-five oak hybrids have been reported,

ed, but one of these, *Q. Rudkini*, has been tested as described above with negative results.

Ranunculaceæ. A hybrid between *Actea alba* and *A. rubra*. *Clematis viornoides* is reported to be of a hybrid nature.

Cruciferae. *Roripa palustris* is supposed to form natural hybrids with *R. obtusa* and *R. sinuata*.

Pomaceæ. *Malus Soulandi* is taken to be a cross between *M. coronarius* and *M. Malmus* by some workers.

Rosaceæ. *Geum strictum* and *G. Canadense* are supposed to form a hybrid.

Papilionaceæ. A hybrid between *Baptisia australis* and *B. bracteata* is reported.

Anacardiaceæ. *Rhus hirta* is supposed to cross with *R. glabra*.

Rhamnaceæ. *Ceanothus Lobbiana* is taken to be a hybrid between *C. thyrsiflorus* and *C. dentatus*. It is also supposed that *C. thyrsiflorus* hybridizes with *C. papillosus* and *C. sorediatus*.

Violaceæ. A large number of hybrids of *Viola* have been reported.

Onagraceæ. *Oenothera biennis* and *O. Oakesiana* hybridize, the progeny of the first generation consisting of several types.

Cactaceæ. A hybrid is supposed to be formed between two species of *Opuntia*.

Cornaceæ. *Cornus Baileyi* has been taken to be a hybrid between *C. asperifolia* and *C. stolonifera*.

Verbenaceæ. The evidence seems strong that *Verbena Canadensis* and *V. bracteosa*, *V. bracteosa* and *V. hastata*, *V. bracteosa* and *V. urticifolia*, *V. bracteosa* and *V. stricta*, *V. stricta* and *V. hastata*, *V. stricta* and *V. urticifolia*, *V. urticifolia* and *V. hastata*, *V. angustifolia* and *V. stricta*, and *V. angustifolia* and *V. bracteosa*.

Acanthaceæ. *Ruellia ciliosa parviflora* has been supposed to be the result of a cross between *R. ciliosa* and *R. strepens*.

Lobeliaceæ. *Lobelia syphilitica* is supposed to hybridize with *L. cardinalis*.

Cichoriaceæ. *Prenanthes Mainensis* is taken to be a cross between *Nabalus racemosus* and *N. trifolius*.

Compositæ. Hybrids are reported in *Eupatorium*, *Solidago*, *Aster*, *Bidens* and *Helenium*.

The genera noted above are supposed to offer about two hundred hybrids; and as the observations have been made principally with the flora of eastern North America in a region which probably does not furnish more than twenty thousand species, it is to be seen that the questions involved affect about one per cent of the flora. Probably not more than half of the instances included in the above list could be confirmed by actual tests, but on the other hand it is probable that a closer examination would reveal an equal number of actual occurrences.

Some of the constituents of the native flora are known to be constant untypical hybrids, and hence have every claim to be regarded as species. The type of hybridization most widely different from this is illustrated by Bartram's oak, and between these two diverse modes of action may be found. In gaining a more extended and accurate knowledge of the manner in which the qualities of separate unified strains of plants are alternative, or are interlocked, or fractionized in hybridizations, a vantage ground will be gained for the consideration of all questions in genetics as to saltations, minute accretions, and fluctuations of such characters.—Botanical Gazette.

THE FEAR OF OPEN AND CLOSED SPACES.

By CHARLES MERCIER, M.D.

AGORAPHOBIA, or fear of open spaces, is not nearly as common a malady as its antithesis, claustrophobia. Both are curious, and somewhat anomalous, states of mind, in which an aversion, which is known and admitted by the subject of it to be irrational and absurd, nevertheless dominates conduct, prompts the execution of irrational acts, and renders certain rational and desirable acts impossible.

If I had to speculate on the origin of these curious and spurious instincts, for such they may be termed, I should assign them to the revival of instincts which existed in full force, and had great biological value, in our remote ancestry, but which in most of us have long been obsolete. When our ancestors were arboreal in habit, this habit was their salvation from extinction. Feeble in body, destitute of weapons and of defensive armor, devoid of means of concealment, their safety from carnivorous foes lay in the agility with which they could climb out of reach, and in the accuracy with which they could leap from bough to bough and from tree to tree. Whenever they descended to the ground, they were in danger. It is on the ground that the greater carnivora pursue their prey; and, adapted as our ancestors were to arboreal life, their progress on open ground was undoubtedly less rapid than among the tree tops, and most probably less rapid than that of their principal foes. Among the tree tops they were secure. There, no enemy could vie with them in activity, or hope to overtake them; but on the ground they were at a disadvantage. On the flat, they had no chance against the spring of the panther or the speed and wind of the wolf; but once let them attain the security of the forest, and they could grin and chatter with contempt at their helpless enemies below. The farther they ventured from their secure retreat, the greater the peril they were in; the nearer their refuge, the more complete their sense of security. Since instincts, using the term in the sense of mental cravings, become adapted to modes of life, which, in turn, they dictate, we may be sure that, in the arboreal stage

of their existence, our ancestors had a very strong instinctive aversion to any extended excursion from their place of security and refuge. Near to trees, they were in safety; far from trees, they were in continual danger, and therefore in continual uneasiness. In such a situation they had an abiding and well-founded dread and sense of impending danger.

This is the state of mind which, as it seems to me, is reproduced in similar circumstances in agoraphobia. The craving of the subject of this malady is to be near, not trees necessarily, it is true, but near to some tall vertical structure. Away from such a structure, he has just the feeling of dread, of impending danger, of imminent disaster, of something dreadful about to happen, that a man would have who was walking through a jungle infested by tigers, or that a child has when alone in the dark. And this is just such a feeling as we may suppose our arboreal ancestors had when they were out of reach of their natural habitat. I have seen a woman affected with agoraphobia get from one side of a court to the other by not only going round by the wall, and touching it all the way, but squeezing herself up against it, and clutching at the bare surface. Sufferers from this malady cannot cross an open space. They cannot venture more than a step or two from some vertical surface. They feel no uneasiness in a colonnade, open all around them though it be. Their reason tells them that their dread is groundless, but reason is powerless against instinct, and an imperious instinct shouts danger in their ears.

The opposite malady—claustrophobia—seems to me to reproduce a state of affairs of much later occurrence in our racial history. When arboreal habits at length began to be abandoned, and our anthropoid ancestors began to shelter themselves in hollow trees, in caves, and holes in the ground, there must often have been a conflict between the immeasurably old, primitive habit of roosting under the open sky and the modern innovation of taking shelter from the weather. The sense of confinement must have been very irksome. We may be sure that there was no sudden revolution in the mode of life. The new habit was adopted very gradually. Only in some very violent storm would the first indwellers creep into a hole for shelter, and they would soon find their circumscribed quarters intolerable, and brave the elements as soon as the weather began to moderate. Perhaps the new instinct was first implanted in the young, by the parents bestowing their tender offspring in holes during their own absence or when cold and rain became severe. It is not easy to teach an old dog new tricks; but a young wild rabbit or squirrel, taken at a very early age from the nest, never acquires the untamable wildness that is so conspicuous a feature in the character of the old. In any case, the habit of taking shelter in more or less closed spaces was a habit of slow and gradual acquirement; and we may be sure that it was not acquired without many a relapse and many a backsliding. We can almost hear the jeers and scoffs of the stout old Tory anthropoids at the effeminacy of their degenerate juniors, who should seek a shelter that their forefathers would have scorned. The habit has not yet been fully acquired by all our race, for we see, even at this late day, many persons of human status to whom the shelter of a roof is abhorrent, and who prefer, in the worst of weather, to lie out under a hedgeside rather than submit to the restraint of roof and walls.

It is to the imperfect acquisition of this later instinct of seeking shelter in confined spaces—or rather it is to the re-assertion over it of the more remote and earlier instinct of craving for the open sky, and irksomeness of confinement—that the malady of claustrophobia seems to me to be due. In the subject of this malady is revived in its original strength that craving for open sky and open air, for possibility of movement in every direction, which were ingrained in our ancestors by their free arboreal lives; and which were overcome with such difficulty when first they descended to inhabit *terra firma*. Like the sufferer from agoraphobia, he who suffers from claustrophobia experiences the revival of an ancestral instinct that has been obsolete for untold generations, but that has been lost more recently than that revived in agoraphobia. Since it existed down to a later date; since it has been more recently lost, it is more easily revived; and this is the reason, I think, that claustrophobia is so much less rare than agoraphobia.—London Lancet.

ATMOSPHERIC DUST.

THE importance of dust in the economy of the atmosphere is not to be underrated, but neither should it be overestimated. If dust is present in the air, the light reflected therefrom has various tints of gray or red, depending on the size and nature of the particles of dust, but if no dust is present, light may be reflected from any minute particles of water or ice that happen to be present, and these are not generally called dust. Molecules of water or ice sometimes form minute drops by gathering about particles of dust as nuclei, but they can also form such drops without dust as nuclei, and must frequently do so. However, if neither dust nor water were present in the atmosphere, we should still have our ordinary blue sky light, and some sunset sky colors. The deep blue of the sky is due almost entirely to the selective dispersion of the various waves or rays of light that come from the sun, by the action of the molecules of the constituent gases of the atmosphere. The ability of these molecules to absorb and reflect any given wave length depends upon the relative dimensions of the wave and the molecule. The exact relation has been carefully worked out by Lord Rayleigh, whose formulæ explain not only the blue color of the sky, but

also the polarized condition of that light. Dust particles and ordinary water or ice particles are relatively so large that they reflect all rays of light, with a slight possible predominance of the red rays or long waves; consequently the hazy whites and grays of foggy weather and the dirty reds of the Indian summer may be attributed to dust and vapor, which in fact obscure the deep blue sky light.

Aqueous vapor in its finest condition, when it begins to condense without the help of dust nuclei, has the power of selectively reflecting the longer or bright blue as distinguished from the shorter dark blue of the pure upper sky; the resulting bluish haze may often be seen under favorable atmospheric conditions when we look at a distant landscape, and especially in the pure air of oceanic islands. The blue haze off the west coast of Scotland is proverbial. This haze was first studied in the laboratory by Tyndall, when he produced it unexpectedly by allowing dustless moist air to expand inside the vacuum tube.

The beautiful colored sunsets observed in connection with the eruption of Krakota, and especially the brilliant colors brought out by Prof. Carl Barus, of Brown University, in his study of cloudy condensation, are not due to dust nor to the selective reflection by fine particles, but are examples of a very different process, i. e., the colors of thin plates, or what Newton called the colors of thin films. The central portion of each little sphere of water transmits a minute beam of sunlight which has been reflected to and fro within the sphere, and its waves have interfered with each other. Some have been reinforced and others have been annulled. The former give the beam that is seen by the observer, and its color depends on the diameter of the sphere or the thickness of the film of water.

In general, therefore, our beautiful atmospheric colors are not altogether due to dust.—Monthly Weather Review.

TRADE NOTES AND FORMULÆ.

Zwieback Extract.—It is stated that these extracts, which are said to be of Dutch origin, contain a large quantity of soap. This admixture of soap is probably intended to produce the flaky, frothy dough so greatly valued in biscuits and zwieback, and these extracts are expressly recommended for use in the baking of the latter.

Heated Circular-Saw Blades.—Circular-saw blades that have run hot should not, as the Allgemeine Tischlerzeitung observes, be cooled with cold water, as they are liable to warp or become distorted. The cooling must be gradual; the saws should be allowed to run free for at least five minutes, and then gradually to stop of their own accord. Only in extreme cases may an attempt be made to accelerate the cooling process by the admission of air.—Neueste Erf. u. Erfahr.

Practical Directions for Making Ink Eradicators.—Dip a thick piece of white absorbent (blotting) paper into a solution of 100 parts of oxalic acid in 400 parts of alcohol; keep the paper in the liquid until it is thoroughly saturated, and then dry by suspending in the air. Aniline ink spots cannot be removed by this paper. Since, however, ink containing iron is much more commonly used than aniline ink, this paper will be found indispensable for the office when once introduced.—Neueste Erf. u. Erfahr.

To Make Varnish for Roofs.—The following recipe for preparing varnish for roofs is given by the Erste österreichische Dachdeckerzeitung: 700 parts by weight of distilled coal-tar are heated in a boiler and 70 parts degreas added when the tar is still liquid. This should be constantly stirred, and a mixture of 175 parts by weight of washed brown coal ashes, 20 parts of flowers of sulphur, and 35 parts of alum gradually added. The varnish is applied hot, like other varnishes. Sanding the roof does not appear necessary, as the varnish dries quickly and will not drip off.—Neueste Erfindungen und Erfahrungen.

A Paste Which Will Adhere to Tin.—According to a communication to the Apothekerzeitung, Lemoine prepares a paste which will adhere to tin by mixing 2 parts of tragacanth powder with 16 parts of boiling water, vigorously stirring the liquid and allowing it to settle. A mass is made, at the same time, of 4 parts of cold water, 6 parts of rye flour, and 1 part of dextrine and added to the tragacanth solution. This liquid is then mixed with 24 parts of boiling water, stirring constantly, and further with 1 part of glycerine and 1 part of salicylic acid; the whole mass is next boiled for three to four hours, stirring as before. This mixture is somewhat complicated. I have found that ordinary starch paste, with the addition of some glycerine, also possesses the property of adhering to tin, and this simpler compound will probably suffice for most purposes.—Neueste Erf. u. Erf.

To Clean Marble Slabs.—Though we have on a previous occasion given directions for cleaning marble, we must not omit mention of some new information on this subject communicated to the Pharmazeutische Post by the engineer and chemist, A. Gawalowski. Grease spots may be covered to the thickness of the little finger with a paste made of magnesium and benzine, and the dried magnesia crust removed in one to two hours. Extract spots can be removed in the same manner by a paste composed of talc, fibrous gypsum, lemon juice, citric acid, and tartaric acid or oxalic acid with alcohol and diluted. Or a bleaching paste is made from barium peroxide and dilute sulphuric acid, mixing these ingredients at a very low temperature and avoiding acid reaction, i. e., excess of sulphuric acid, and applying as above. According to

Gawalowski, calcium peroxide, magnesium peroxide, or zinc peroxide answers the same purpose. The marble is afterward polished with putty powder and paraffine oil.

ENGINEERING NOTES.

The treatment of unsuitable feed water for locomotive use has long been recognized as a necessity, and crude methods with such practical means and facilities as have been available, have been practised for many years. With the increased capacity of locomotives, the amount of water evaporated and the supply of water required has resulted in the necessity for improved apparatus and storage capacity to provide for such chemical treatment, which, combined with mechanical means, will produce the best results.

An iron smelting plant having steam turbines and gas fired boilers in the power station may at present consume all of its available gas in the blast furnace and steel works. If a corresponding allotment for rolling mills is to be added, or if other industries are attracted to settle in the neighborhood, or if some community or city would build up in the immediate vicinity of the plant to whom it might be desirable to sell power at a profit, then the works management would be confronted by the necessity of either buying good steam coal, or else of consigning steam turbines and boilers to the scrap heap and of replacing them by gas engines able to generate the required additional energy from the available gases or other waste at no additional cost.

The fact that the compound can be replaced by the simple locomotive, with increase of power and low pressure in the boiler, is an advantage of superheated steam, even if no economy in fuel is obtained. As superheated steam applied to locomotives gives a higher thermo-dynamic efficiency than that realized from compound locomotives using saturated steam, it will enable the possibility of obtaining the advantages of compounding, without the introduction of the objectionable features. The possibility for increasing the capacity and economy of present locomotives by superheating is of even greater importance, as boilers which may be deficient in design or capacity can be much improved in effectiveness, and superheaters can be applied without altering the general design or construction of the boiler or mechanism.

The conditions which will beset the engineer of the twentieth century will be exacting beyond anything we now know. The importance of a strong foundation in scientific principles cannot be overestimated, for scientific principles are only the laws of nature. These principles cannot be learned readily after a man has begun his life work. His whole energy will then be devoted to applying these principles correctly, not in acquiring them laboriously. It will be a prime necessity for the technical college of the future to lay these foundations broad and deep. It will be regarded as a weakness for a college to teach its students only the knacks of the profession, only just enough to be an ordinary draftsman, a tolerable surveyor, or first-class linesman.

It sounds a strange thing to say that good drainage is in some degree synonymous with good dividend. In all civil engineering work, however, judicious first cost and the exercise of skill in properly dealing with water ultimately saves much money in maintenance. Most of the ills the civil engineer is heir to are attributable to the effects of water; and from the point of view of the economies of the maintenance of works, water may be described as the greatest of the forces of nature with which the civil engineer has to contend. The debit of maintenance and revenue account in respect of remedial work necessitated by the action of water is enormous; young engineers should mark specially, and inwardly digest the saying attributed to a well-known Scottish contractor of the recent past: "Ye canna cheat water." Never was there a saying more true. It is not so much the impetuous flood and the flowing tide that one has to guard against, and never forget, in the design of works from the point of view of maintenance, but rather the terribly insidious and stealthy action of water, which never stops, and which inevitably results in decay as silent and as certain as the grave.

An invention which will prove of widespread utility to the textile industry has recently been devised conjointly by three English engineers for tow-carding upon an extensive scale. The machine is essentially of the labor-saving class, it being possible to accomplish as much therewith as has hitherto required fifteen hands. Tow, the by-product of flax, has heretofore always necessitated hand-feeding into the carding machines—one hand to each card. With this machine, however, this requisition is dispensed with. The tow to be carded is sorted and weighed, and then discharged through a shoot onto the table of the machine below. The operator here controls the feeding of the tow into the machine. The material is drawn into the lapper, as it is called, by a sheet and shell feed roller. It is then struck sharply by a rapidly-revolving cylinder, and discharged on to a traveling lattice sheet, which carries it forward to a set of pressing rollers. It is here formed into a large sliver, and is then lapped on to a wood core some 18 inches in diameter. When finished on the core the laps are doffed by hand, the full lap being withdrawn and the new core inserted without stopping the machine. The lap, which is 56 pounds in weight, is placed on a carrier and transported by an elevated railroad to the carding machines and deposited where required. This