c's, as has been done in our recent manuals. If, on the other hand, we adhere to the view that a name, to be worthy of acceptance, must be in Latin form, we have no recourse but to abolish 'graminoides,' 'polyclavatum,' and the other hybrids, relegating them to the same limbo of obscurity with *Gansblum*, *Catjang*, *Rulac* and similar creations.

After uniformity in recognizing the rights of the doctrine of priority, the most important thing is to secure uniformity in our treatment of the names assured to us through the operation of that principle. It is true here, as in most other affairs, that the fewer exceptions we admit, the greater the practical benefit of the rule. At the present time our writers are serenely pursuing their individual preferences, correcting a name when they deem it advisable to do so, or even making substitutions of one name for another through one of the causes above discussed. It matters little whether we establish a rule of absolute permanency, retaining names in exactly the form in which they were first published, or whether we admit certain fixed exceptions; but the determination of a case should always be settled by authority and never left to personal caprice. No principle can be maintained if it is to be followed only at discretion.

One practical obstacle to any improvement of existing conditions is to be found in the tendency of the age itself. In this connection, let me quote a paragraph or two from the article by Professor Greene above referred to:

"It is easy to trace to its origin this condition of scanty mental equipment evinced by a great number of the botanical writers of to-day. Young men of the present are more than ever in haste to be earning wages and getting rich. It is a vulgar spirit which pervades—it is everywhere confessed—all classes of youth, as well as of older people. Even they who aspire to what were once known as the learned professions, will hardly allow themselves the expenditure of time, not to say money, that is necessary to acquire anything beyond the most elementary and superficial education. * * * Nature study is captivating, perhaps much more so than grammatical, linguistic and metaphysical studies, to youth in general. There is no doubt of that. Neither need it be called in question that even a single branch of natural history study, long and ardently pursued, must have the effect of training a mind to careful and minute observation, and to reasoning and reflecting, and this is an important part of an education. But in our time few if any nature students are content with observing and thinking. All must write and print; and this whether they have or have not learned to write."

Against this somewhat discouraging state of affairs we are to set the tendency of the present time to recognize law as paramount and personal judgment as an uncertain guide. If botanists of all schools can be brought together in a strong and united effort to improve the literary and etymological side of nomenclature, it will not be difficult to secure agreement upon some sound general principle which will command the respect and win the adherence of every working scientist. There is here a subject upon which conservatives and radicals may unite, and a condition of affairs which cries aloud for attention and reform.

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THE USE OF HYDROCYANIC ACID GAS FOR EXTERMINATING HOUSEHOLD INSECTS.

WITH the growth of our population and the consequent crowding together of residences, the problem of the prevention and control of household insects is deserving of careful consideration from a sanitary stand-

point, but one that is usually overlooked. These pests are to be found in fewer or greater numbers of both species and individuals in every dwelling, office or storehouse, and no perfectly efficient means either to prevent their gaining an entrance, or to exterminate them when they are once established, has as yet been devised.

Recent successful applications of hydrocyanic acid gas for the extermination of insects infesting greenhouse plants have suggested the use of the same remedy for household pests. It is now no longer a theory, but an established fact, that .10 gram of 98-per-cent.-pure cyanide of potassium volatilized in a cubic foot of space will, if allowed to remain for a period of not less than three hours, kill all roaches and similar insects.

The experiments which led to this conclusion were made in a small building which is used for laboratory purposes by the Division of Botany. This structure has for some time been infested with several insect pests, the more numerous and troublesome being the common cockroach (*Periplaneta americana*). The building consists of one story and basement, the upper part being rather loosely built, as it is ceiled throughout with matched lumber. This method of construction provides numerous hiding places for the insects and also renders fumigation difficult, by permitting the gas to escape too quickly. Within the building are several sources of moisture, a rather high and constant temperature is maintained in some of the rooms, and large quantities of seeds and substances that serve as food for insects are stored, making conditions well adapted to the development of cockroaches.

During the early part of last year the roaches became so numerous as to be a detriment to the work of the laboratory and it was necessary to adopt some means of checking them. On the evening of May 10, 1900, the building was closed, and after opening up the interior of the rooms as much as possible the entire structure was fumigated experimentally with about .08 gram of 98-per-cent.-pure cyanide of potassium per cubic foot of space. The gas was allowed to remain during the night, or until it gradually escaped. When the rooms were entered the following morning there remained a perceptible odor of the gas, but this soon disappeared after opening the windows and doors. The ledges and window sills were strewn with dead houseflies and the floors bore abundant evidence of the effect of the gas on roaches. Not a single insect that showed indications of remaining life was to be found in the building. About a quart of the flies and roaches was gathered up and placed in a cage where they were allowed to remain until the following day, when two roaches showed signs of life by slow movements; these, however, could not walk when placed upon their feet and subsequently died.

For some time after this fumigation no roaches were to be found in the building, but eventually the eggs that had been previously deposited hatched and developed, adults were carried in from other buildings, etc., until in March of the present year the roaches had again become so numerous as to be a nuisance and a detriment to the work of the laboratory. The building was again treated with cyanide gas, this time at the rate of .10 gram per cubic foot of space, but was allowed to remain only fifty minutes, when the windows were opened and the gas permitted to escape. The roaches were strewn over the floors and several mice were found dead. A large number of the roaches were again collected and kept in a cage until the following day, when it was found that fully ten per cent. of them had not been killed and were as lively as before treatment; the mice, however, showed no

indications of life. The dose had been sufficiently strong, but had not been allowed to remain long enough to kill the more resistant of the roaches.

The third and most satisfactory experiment of the series was conducted on the evening of June 20, 1901, when an application of .10 gram per cubic foot was allowed to remain in the building over night. On the following morning the gas had not entirely escaped, and house-flies, centipedes, spiders, cockroaches, and mice were dead, with the exception of a few roaches that had secreted themselves between the sash and frame of a loosely fitting window and had thus secured enough pure air to prevent their being killed.

To convey an idea of the injury caused by the presence of large numbers of roaches in this laboratory it might be stated that frequently preceding this last fumigation, photographic plates placed on racks to dry and allowed to remain on a table for one hour were completely ruined by having the films eaten from the glass; packets of seeds stored in mouseproof tin boxes were so eaten as to allow the seeds to escape and in many cases the seeds themselves were destroyed. Since this fumigation no inconvenience has been caused by the work of roaches or mice.

By aid of the results obtained from the above experiments, together with our present knowledge of the action of hydrocyanic acid gas in exterminating greenhouse and scale insects, it may be stated that a dwelling, office, warehouse or any building may be economically cleared of all pests, provided that the local conditions will permit the use of this gas. It probably would be dangerous to fumigate a building where groceries, dried fruits, meats, or prepared food materials of any kind are stored. Air containing more than 25 per cent. of the gas is inflammable, therefore it would be well to put out all fire in an inclosure before fumigating. Hydrocyanic acid in all its forms is one of the most violent poisons known and no neglect should attend its use. There is probably no sure remedy for its effects after it has once entered the blood of any of the higher animals. When cyanide of potassium is being used it should never be allowed to come in contact with the skin and even a slight odor of the gas should be avoided. Should the operator have any cut or break in the skin of the hands or face it should be carefully covered with court plaster to prevent the gas coming in contact with the flesh, or the possibility of a small particle of the solid compound getting into the cut, which would cause death by poisoning within a few minutes' time.

Hydrocyanic acid gas should not be used in closely built apartments with single walls between, as more or less of the gas will penetrate a brick wall. An inexperienced person should never use cyanide of potassium for any purpose, and if it be found practicable to treat buildings in general for the extermination of insects the work should be done only under the direction of competent officials. Our experiments have shown that a smaller dose and a shorter period of exposure are required to kill mice than for roaches and household insects generally, and it readily follows that the larger animals and human beings would be more quickly overcome than mice, since a smaller supply of pure air would be required to sustain life in mice, and small openings are more numerous than large ones.

The materials employed and the method of procedure are as follows: After ascertaining the cubic content of the inclosure, provide a glass or stoneware (not metal) vessel of two to four gallons capacity for each 5,000 cubic feet of space to be fumigated. Distribute the jars according to the space and run a smooth cord from each jar to a common point near an outside door where they may all be fastened; sup-

port the cord above the jar by means of the back of a chair or other convenient object in such a position that when the load of cyanide of potassium is attached it will hang directly over the center of the jar. Next weigh out upon a piece of soft paper 500 grams (about 17.1 ounces) of 98-per-cent.-pure cyanide of potassium, using a large pair of forceps for handling the lumps; wrap up and place in a paper bag and tie to the end of the cord over the jar. After the load for each jar has been similarly provided, it is well to test the working of the cords to see that they do not catch or bind. Then remove the jar a short distance from under the load of cyanide and place in it a little more than a quart of water, to which slowly add one and one-half pints of commercial sulphuric acid, stirring freely. The action of the acid will bring the temperature of the combination almost to the boiling point. Replace the jars beneath the bags of cyanide, spreading a large sheet of heavy paper on the floor to catch any acid that may possibly fly over the edge of the jar when the cyanide is dropped, or as a result of the violent chemical action which follows. Close all outside openings and open up the interior of the apartment as much as possible in order that the full strength of the gas may reach the hiding places of the insects. See that all entrances are locked or guarded on the outside to prevent persons entering, then leave the building, releasing the cords as you go. The gas will all be given off in a few minutes, and should remain in the building at least three hours.

When the sulphuric acid comes in contact with the cyanide of potassium the result is the formation of sulphate of potash, which remains in the jar, and the hydrocyanic acid is liberated and escapes into the air. The chemical action is so violent as to cause a sputtering, and frequently particles of the acid are thrown over the sides of the jar; this may be prevented by supporting a sheet of stiff paper over the jar by means of a hole in the center through which the cord supporting the cyanide of potassium is passed, so that when the cord is released the paper will descend with the cyanide and remain at rest on the top of the jar, but will not prevent the easy descent of the cyanide into the acid. The weight of this paper will in no way interfere with the escape of the gas.

At the end of the time required for fumigation the windows and doors should be opened from the outside and the gas allowed to escape before any one enters the building. A general cleaning should follow, as the insects leave their hiding-places and, dying on the floors, are easily swept up and burned. The sulphate of potash remaining in the jars is poisonous and should be immediately buried and the jars themselves filled with earth or ashes. No food that has remained during fumigation should be used and thorough ventilation should be maintained for several hours. After one of our experiments it was noted that ice-water which had remained in a closed cooler had taken up the gas and had both the odor and taste of cyanide.

For dwellings one fumigation each year would be sufficient, but for storage houses it may be necessary to make an application every three or four months to keep them entirely free from insect pests. The cost of materials for one application is about fifty cents for each 5,000 cubic feet of space to be treated. The cyanide of potassium can be purchased at about thirty-five cents per pound, and the commercial sulphuric acid at about four cents per pound. The strength of the dose may be increased and the time of exposure somewhat shortened, but this increases the cost and does not do the work so thoroughly. In no case, however, should the dose exceed .22 gram or remain less than one hour.

The practical application of this method of controlling household insects and pests generally is to be found in checking the advance of great numbers of some particular insect, or in eradicating them where they have become thoroughly established. This method will be found very advantageous in clearing old buildings and ships of cockroaches.

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*ENGINEERING EDUCATION IN LONDON.**

JUDGED merely by the magnitude and diversity of the work actually carried out within its boundaries, London is by far the most important center in the world for civil, mechanical and electrical engineering. Its vast population includes a larger number of engineering employers and engineering workmen of every grade and in almost every branch of work than any other city can show. The demand for engineering instruction of every type is large and steadily increasing. Yet the provision now existing for engineering instruction can only be described—if we compare it with the needs of London in this age of steel—as trivial. Out of six millions of inhabitants the total number of engineering students above matriculation standard is estimated at 600. What provision there is seems good, as far as it goes, but it is ludicrously below the requirements of London, alike in extent, comprehensiveness, and variety.

The engineering instruction at present available in London consists mainly of three separate 'schools'—the Central Technical College of the City and Guilds of London Institute, University College and King's College—of a high standard of excellence in the somewhat limited work that they undertake, with a small staff of first-rate professors, and good, though not very extensive, equipment. Their main drawback is their limited size and scope, the high fees which they are compelled to charge, and their limitation to day students. Their work is, moreover, narrowly restricted by lack of space, lack of staff and lack of funds. They contain, in the aggregate, only about 350 students in all branches of engineering. Supplementing these three 'schools' (which are all situated in West Central London, within an area of three square miles) there are about a dozen less completely organized centers of engineering instruction, each with one or two professors and instructors of university rank, aided by subordinates dealing with the less advanced classes. These include the Finsbury Technical College of the City and Guilds of London Institute, where first-rate professors deal with junior students, and the several 'polytechnics,' dealing with all ages and classes of engineering pupils. These centers are conveniently distributed in the different parts of London; they provide both day and evening instruction, and their engineering departments are rapidly increasing in size and importance. Their equipment and workshop accommodation, so far as mechanical and electrical engineering is concerned, is usually good, though somewhat limited. Besides many hundreds of elementary students in various engineering subjects, they contain in the aggregate about 250 engineering students doing work of university standard. This work could easily be extended, by strengthening the staff and improving the equipment of the several institutions, to an almost indefinite extent.

If we turn now to different branches of engineering, it may be noted that (apart from the Royal Naval College at Greenwich, which is not open to the public) absolutely no provision exists in London for instruction in marine engineering and naval architecture. Though the Thames is still one of

* From the London *Times*.