to the volatilization of the nicotine. In order to produce a more rapid liberation of the nicotine, various "activator" substances, such as hydrated lime, lime-sulfur, an ammonium sulfate, have been added to the spray and dust. Attempts have also been made to increase the effectiveness of nicotine dust by discharging into the blast of dust the exhaust of the gasoline engine operating the blower, the slightly higher temperature tending to liberate the absorbed nicotine and produce a greater degree of volatilization.

Various insects attacking plants in greenhouses have been controlled by the vapor of nicotine produced by burning tobacco stems or a material on which nicotine has been placed, and by placing nicotine on a heated object.

The new device, which we have designated a nicotine vaporizer, has been designed with the object of effecting the control of insect pests of orchard, garden and field crops by means of nicotine sulfate or any form of nicotine concentrate applied as a vapor produced by heat or as a vapor-like mist produced by atomization. The essential features of the device provide for atomizing the nicotine, conveying the mist through a heated chamber where it is vaporized with the formation of dense fumes, and thence conveying the vapor through a blower to the vegetation; or the finely atomized nicotine may be conveyed through the blower to the vegetation without being vaporized.

The machine which we have built and tested operates in the manner described as follows: The nicotine is contained in two chambers connected through a pressure regulator to a compressed air tank. Tubes arranged to produce atomization lead from the chambers and discharge into two copper pipes 2 inches in diameter and 30 inches in length. The pipes are inclosed in a shield to conserve heat. They are heated to a temperature of approximately 350° C. by a gas burner, utilizing compressed gas, extending lengthwise below them. The pipes extend into the intake of the blower of a standard type of duster used in insect control work. The blast of air from the blower carries the nicotine vapor or the atomized nicotine to the vegetation. The rate with which the nicotine is fed through the atomizer is governed by the pressure regulator.

Tests made with the vaporizer in the control of the codling moth, *Carpocapsa pomonella* Linn., have indicated that nicotine applied as a vapor is far more potent as an insecticide than where applied in the usual form of a spray or a dust. It is a well-known fact that nicotine has no appreciable effect on the codling moth where applied as a dust, or as a spray at the usual concentration of one pint of nicotine sulfate to 100 gallons of water. An apple tree having a volume of approximately 4,000 cubic feet requires about 20 gallons of spray in order to effect a thorough coverage. With this quantity of spray the tree receives 90 cubic centimeters of nicotine sulfate. Tests have shown that 10 cubic centimeters of nicotine sulfate properly applied with the vaporizer will kill all the moths in a tree of this size.

The effectiveness of the treatment depends upon the concentration of the vapor in the atmosphere surrounding the insect and upon the length of time the insect is subjected to the vapor. The maximum degree of effectiveness is secured by discharging the vapor under a canvas cover dragged over the crop to be treated. For the treatment of orchard trees we have built and tested, with a fair degree of satisfaction, a device by means of which large trees may be inclosed and treated at the rate of one tree each half minute. This device consists of a transverse boom extending over two rows of trees, supporting a large canvas cover, adjustable for trees of different sizes, and provided with two curtains which permit inclosing the trees quickly and completely, all mounted on an automobile truck.

The development reported in this article owes its origin to a suggestion to try burning nicotine, made by the junior author, Mr. Persing, in connection with tests on fumigating with hydrocyanic acid to control the codling moth.

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PRODUCING BRAIN LESIONS IN RATS WITHOUT OPENING THE SKULL

HERETOFORE all localized brain lesions in experimental animals have been produced by opening the skull and introducing some destructive agent, usually a knife or a thermocautery. Using heat as the destroying agent, we have found it possible to shorten and simplify the older procedure considerably by applying the cautery point *extracranially*. If a knife is used, it is of course necessary to trepine the skull. Heat, however, will readily penetrate the unremoved bony shell sufficiently to coagulate the underlying tissues. This technique is especially feasible when the skull bones are thin, as in the rat.

On some occasions, there may be good reasons for the use of a cutting edge and hence for removal of a portion of the skull. Even when tissue is destroyed by heat, there may be occasions when the heat should

be applied directly. Nevertheless, we are of the opinion that the current practice of trepining before thermocautery is a neurological tradition rather than an ideal procedure. In a species with poorly marked cortical surfaces, it can not be of much aid to have the surface in view at the moment of operation. The maps of lesions presented by current investigators do not indicate that the prevailing techniques consistently produce the desired destruction. In consequence of this lack of control of cerebral lesions, the researcher produces lesions in many animals and selects for study the animals which happen to possess the sort of destruction which he wishes to study, disregarding the remainder.

This general procedure must be followed today, regardless of how the lesions are produced. If a hot instrument is applied extracranially, the production of lesions is an extremely easy process. The rat is anesthetized, the skull exposed, the cautery applied (in our instance, for fifty seconds), the wound sewed and covered with collodion. Aside from preliminary anesthetization, the entire operation can be performed in three minutes. The skull is left intact. Far from being a cruder method, this method seems to us to provide as good or even better control of the lesion than does the more complicated technique.

The technique has been entirely successful in meeting our needs. We wished to destroy all or most of the striate area. By examining the relation between the striate area and the skull markings, we determined where the cautery should be applied. Experimentation upon rats other than the main experimental group showed what duration of exposure to the heat would most often produce the desired destruction. Examination of sections, to be reported in detail later, show that the desired effect with respect to location, depth and shape of lesion was produced more often than reports of other investigators would lead one to expect from the employment of the traditional methods.

Our lesions were in general round in shape, two millimeters in diameter and were limited to the cortex. It seems likely, however, that one could devise cautery points which would produce lesions of almost any desired shape, and that these lesions could be produced at any point adjacent to the skull. The depth of the lesion may be controlled by varying the duration of the application of the heat, or by varying the intensity of the heat. It is even possible that almost complete decortication might be produced by applying a relatively small cautery point to many areas or by making a metal cap to fit the skull and then applying it when heated.

In addition to simplicity, the technique has the advantage of completely avoiding exposure of the cranial contents to the danger of infection.

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SPECIAL ARTICLES

A FILTERABLE VIRUS RECOVERED FROM WHITE MICE

DURING recent work with the viruses of equine encephalomyelitis and hog cholera an infective agent was obtained from white mice which was pathologically and serologically distinct from both viruses. Its origin was not definitely known, but it seemed likely that the natural host of the agent was the mouse, in spite of the fact that in our mouse colony no disease had been previously recognized. In an experiment designed to trace the origin of the infectious agent, 60 five-week-old, healthy-looking mice from our colony were each given an intracerebral injection of a small amount of sterile bouillon. Fifty-one of these mice showed no evidence of illness during the three weeks that they were under observation. Four died in from 3 to 13 days following the inoculation, and three were killed on from the sixth to the eighth day when they showed symptoms similar to those observed in the mice inoculated with the unknown agent. On the sixth day two additional mice that showed photophobia but no other symptoms were killed. From one of these mice no material was obtained for inoculation, but bacteriologically sterile suspensions of the brain of each of the other eight when injected into guinea-pigs caused symptoms which could not be differentiated from those produced by the original material. This experiment, together with others, suggests that the infectious agent is carried by apparently healthy mice in our colony and that symptoms may be brought out by the intracerebral injection of foreign protein.

Among the mice from our colony only about 60 per cent. develop symptoms after intracerebral injection of infectious material and only 40 per cent. die. The incubation period is from 5 to 10 days. The clinical symptoms are somnolence, photophobia, tremors of the legs, followed by tonic spasms of the muscles of the hind quarters, shown when the mouse is lifted by its tail. Paralysis has not been observed. One of 30 mice inoculated with infectious material by the intraperitoneal route developed symptoms, while