burette and fall in the chamber "F." When H_2 is reached, cock "C" is quickly turned to connect "R" with "F." This cuts off the burette and returns the fishes to their native element quickly and with a single operation. The second burette reading may now be taken at leisure. By operating in this manner, the living material is removed from the water only an extremely short time, and in the species used no injurious effects have thus far been detected.

After the reading has been made and the fishes removed from chamber "F," by pouring out, the flexible connection between "F" and "C" allowing of this, the burette is drained through its other outlet by means of the lower cock and the device is again ready for operation. All parts except the reservoir "R" are mounted on a narrow vertical board, more compactly than shown in the diagram.

The second reading is subtracted from the first, the result representing the number of cc of fluid in the chamber "F" between H_1 and H_2 minus the mass of the fishes. Subtracting this figure from a "blank" run under similar conditions (representing the capacity of "F" between the two levels) the mass of fish in cc is obtained.

It is evident that this device could be applied to a wide variety of aquatic laboratory animals, and for many statistical purposes concerning such problems as growth, respiration, population concentration, *et cetera.* The degree of accuracy attainable is largely a matter of design. For very fine work, the burette "B" may be replaced by a chamber slightly smaller than chamber "F," on which may be mounted a microburette. The smaller the diameter of chamber "F" at H_1 and H_2, the greater accuracy attainable. This diameter, which must be based on the material to be used, is clearly the limiting factor for the accuracy of the readings.

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EXPANDING THE TYPEWRITER

PROBABLY every one engaged in scientific work has felt the need of typewriter characters other than those found on the standard keyboard. Special typewriters have been built, but are not satisfactory on account of the human element involved; typists have learned the touch method of operating the standard keyboard and as a rule refuse to use a special machine. In my own work the need has been met by a simple attachment that permits the use of any number of special characters.

A pillar AB in the diagrams is slipped onto the guides C, between which any type bar D must pass before striking the ribbon R. It is held in place by

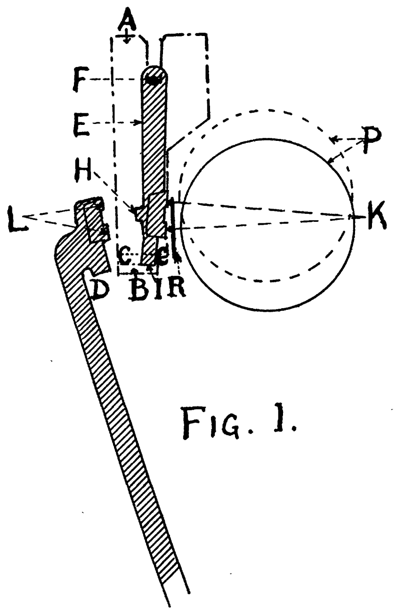

FIG. 1.

friction and can of course be removed easily when the machine is to be used for ordinary correspondence. Even when in place on the guides, it does not entirely spoil the "visibility" of the typewriter. The special characters are soldered to bars such as E designed to be supported by the pillar. Each bar has near one end a rather long axle FG, about which rotation can take place; the projecting ends of the axle provide a convenient means of handling the bar. Each bar carries two characters K; one will print when the typewriter mechanism is in its normal position and

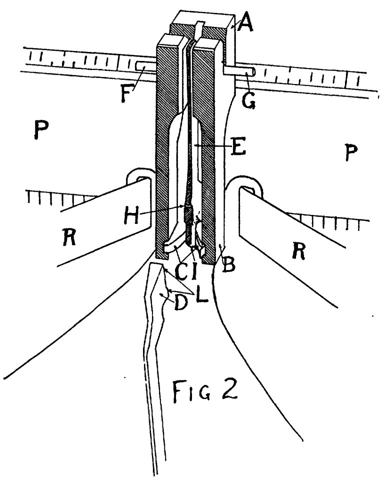

FIG 2

the other when the "shift" key has been depressed. The bar must be set in motion by a blow so that one of its characters may strike the ribbon R and print in the usual manner. The most convenient method of giving this blow is by striking any one of the regular keys. To prevent injury to the type on the typebar thus actuated, for example, bar D in the diagrams, the special bar is provided with a projection H so placed that it will be struck by the blank space between the two characters, L, on D. Exact alignment is provided by the projection I that moves between the regular guides C.

A block of wood with holes in it, properly labeled, serves to store the bars. It may seem offhand that the selection of the proper bar, its insertion in the pillar, the depression of the "shift" key if necessary, the striking of the blow, and the replacement of the bar in the block of wood, consume too much time. Actual experience shows that the entire process requires less time than does the insertion of special characters by hand. The device will make several carbon copies and will, of course, also cut neat stencils.

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SPECIAL ARTICLES

CELERY MOSAIC CONTROL IN FLORIDA BY ERADICATION OF THE WILD HOST COMMELINA NUDIFLORA

A MOSAIC disease of celery (*Apium graveolens*), mentioned by Foster and Weber,[1] has been troubling growers in the Sanford, Florida, district. Doolittle[2] stated that the malady was of virus nature, transmitted by *Aphis gossypii,* and affected a weed, *Commelina nudiflora.* The disease, according to a preliminary report by Wellman,[3] can be controlled by eradication of weeds, mainly Commelina, from about celery fields. As further stated by Doolittle (*loc. cit.*), celery and Commelina are affected by cucurbit mosaic, but subsequent studies by the present writer have shown that the mosaics of celery and cucurbits, though similar, are probably distinct.

Several insects were studied as carriers of celery mosaic. Grasshoppers, crickets, cutworms and other moth larvae, flea beetles, lantern flies, leaf-hoppers and two other species of aphids were used in addition to *Aphis gossypii. A. gossypii* (known as the "celery aphid" in the Sanford region) is the only insect which was found to carry the disease. Both winged and wingless adults were about equally capable of its dissemination, and nymphal stages were less effective.

Celery mosaic is readily transferred from celery to celery by mechanical means. Plants growing close together in the row may bruise each other when pushed over during spraying and cultivation practices, such injury serving to spread the disease without aphid intervention. The disease, as it has occurred in Florida, is not seed-borne in celery.

Commelina, known as "wild wandering-jew" by celery farmers, is found on the banks of drainage canals and in partly shaded areas. The weed is perennial, is propagated by seeds as well as bits of stem and is commonly affected by celery mosaic virus in nature. The disease is not carried in Commelina seeds, but lives from season to season in the growing plants. Careful search disclosed that the celery aphid occurred in small numbers on healthy and diseased Commelina plants. First occurrence of celery mosaic in the field was usually on the edge next to beds of mosaic-affected Commelina. At the outset spread was slow, but as the season progressed it was more rapid. It soon escaped from areas at the edges of the fields, and appeared in numerous isolated spots at some distance from points of origin. This suggestion of aphid flight was verified by subsequent observations. Later, these areas enlarged in all directions, irrespective of prevailing winds or orientation of rows of plants. In the beginning, winged forms of *Aphis gossypii* were the most important factors of distribution. From then on both winged and wingless forms served to spread the malady.

Spraying and dusting experiments to eliminate aphids were conducted by C. B. Wisecup, U. S. Department of Agriculture, Bureau of Entomology, but did not give commercially satisfactory disease control. Successful control of celery mosaic by weed eradication around celery fields has been reported.[4] This work was started in the fall of 1930 and continued until the summer of 1932.

During the winter seasons of 1930–1931 and 1931–1932, four fields were selected and systematic study made from the time of transplanting to harvest. The experimental fields were on farms in the heart of the badly diseased area in the Sanford celery-growing district. In the winter of 1927–1928, on parts of these farms around 70 per cent. of the crop was lost, due to mosaic. In the 1928–1929 season, the losses averaged around 75 to 80 per cent. and in the next season were about 60 per cent. Because of low temperature during the first season of weed eradication, 1930–1931, loss from celery mosaic at harvest on the farm on which no weeds were removed amounted to about 26

[1] A. C. Foster and G. F. Weber, "Celery Diseases in Florida," *Florida Agr. Exp. Sta. Bull.*, 173: 23–77, illus., 1924.

[2] S. P. Doolittle, "*Commelina nudiflora*, a Monocotyledonous Host of Celery Mosaic," *Phytopath.*, 21: 114–115, (abstr.), 1931.

[3] F. L. Wellman, "Control of Celery Mosaic by Eradicating Wild Hosts," *Phytopath.*, 22: 30, (abstr.), 1932.

[4] F. L. Wellman, *loc. cit.*