They were dry and hard, but after wetting them I gave him all he wanted, which was as much as a large tablespoonful. That was unwise, but he was voracious. Next morning, Aug. 6, he was only slightly more inert than usual, but could scarcely swallow a cabbage worm. When given a little juice from blackberries, much to my surprise, he lay over on his side, and died. — And he had never opened his eyes on the troubles of this world.

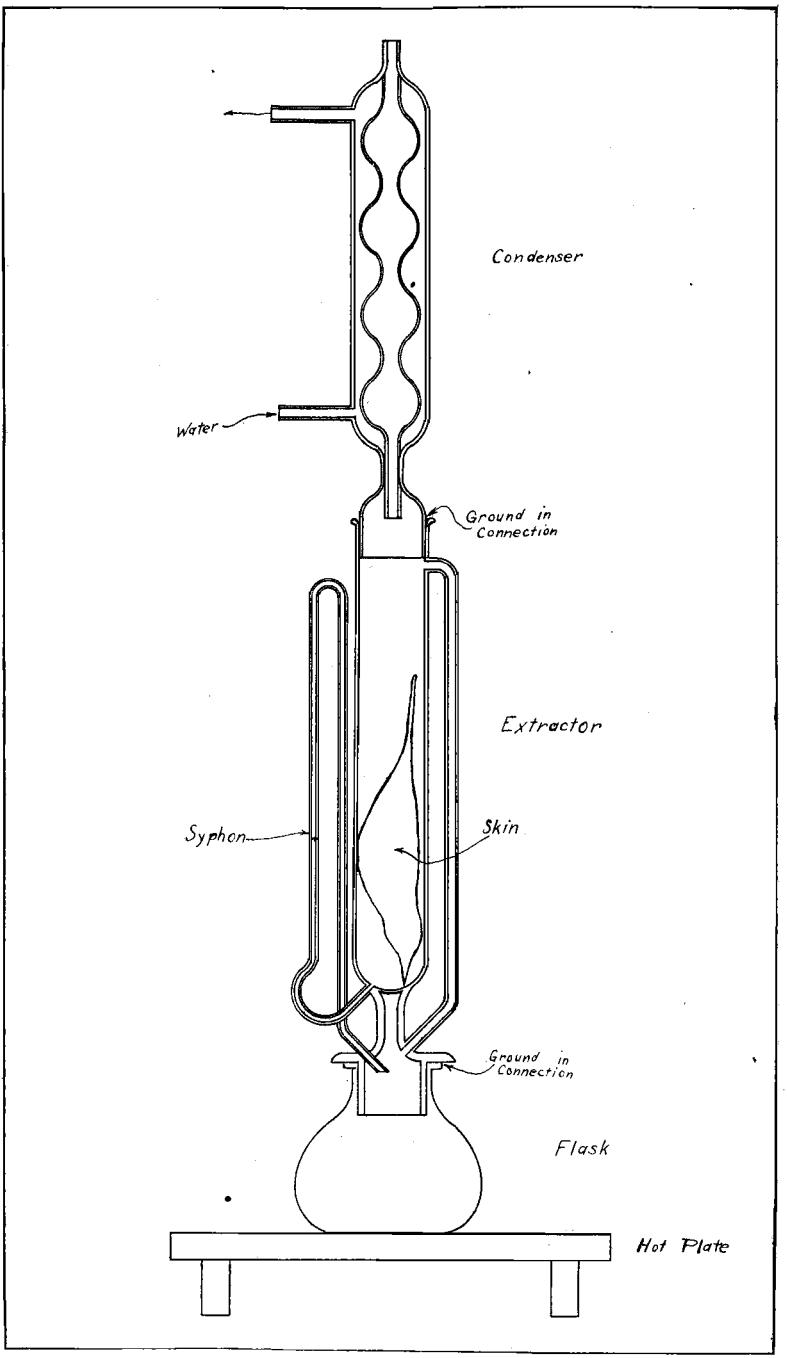
THE EXTRACTION OF FAT FROM BIRD-SKINS.

BY HOYES LLOYD.

MANY valuable bird-skins are rapidly deteriorating, and this work was undertaken with a view to discover a simple method to stop the decomposition of existing specimens and to enable us to prepare specimens which will not decompose from the same causes, in the years to come. If this method succeeds in preventing the imminent total destruction of type specimens and specimens of extinct species, as well as many others of value to the ornithologist I shall be amply rewarded.

The decay of bird-skins is due, apparently, to the presence of fat. This fat gradually spreads over the entire specimen and even saturates the label, in time making it illegible. The fat itself discolors the specimen and every particle of dust with which the specimen comes in contact adheres to the fat, thus increasing the discoloration. Finally, we have a dirty, greasy bird-skin; the feathers are matted and adhere to each other in groups and the specimen does not resemble the living bird in the slightest degree. Then the fat decomposes, perhaps very slowly, and the fatty acids produced slowly attack the skin itself and gradually it falls to pieces and is utterly destroyed.

Washing or wiping the specimen with solvents for fats is only a


Condenser
Water
Ground in Connection
Extractor
Syphon
Skin
Ground in Connection
Flask
Hot Plate

subterfuge and, as all the fat is not removed, the decomposition still continues.

The method which I have found successful consists in washing, soaking and extracting the specimen with automatically repeated doses of the freshly distilled fat solvent. It is an adaptation of the Soxhlet extraction apparatus of the chemist. By this method the entire bird-skin, including the skin, feathers, beak, feet and label, is rendered chemically free from fat, the decomposition due to fat is checked completely, and the future existence of the specimen is probably assured.

The apparatus used is shown in the figure. The one represented is made of glass connected by ground in joints. Cold water is supplied to the invert condenser and heat is supplied to the flask of solvent by an electric light bulb or by an electric hot plate provided with a rheostat so that the temperature can be adjusted. Do not use a flame to heat the flask, as the solvent, ethyl-ether, $(C_2H_5)_2O$ is inflammable and explosive when mixed with air; it boils at 35° C.

The specimen to be cleaned is placed in the extraction chamber, the apparatus is closed, enough ether is poured in the opening in the top of the condenser to charge the syphon twice, and the opening covered with a funnel or loose cap. It must not be closed tight. Then the water is turned into the condenser and the current for the heating apparatus is turned on. Sufficient heat is being supplied when the liquid boils gently.

The ether vapor goes around by way of the by-pass into the condenser, is condensed and falls on the specimen. When the extraction chamber is full of solvent, the first extracting charge syphons automatically into the flask below and carries with it all the fat which it has dissolved. As the operation continues, the specimen is repeatedly washed with freshly distilled ether until not a vestige of fat remains. Two or three hours should complete the operation, but the apparatus can safely be left in operation all night, if it is carefully set up and if the heating apparatus is correctly adjusted.

The operation is completed when the solvent, after passing over the specimen, remains perfectly colorless.

Before opening the apparatus, turn off the heating unit and allow the ether to cool thoroughly. This can be hastened by immersing

the bottom flask in water or in ice water. The ventilation of the room should be good, as the inhaling of ether produces headache and, finally, anesthesia. Remove the specimen and place it on clean absorbent cotton. Dry with a gentle blast of clean air, or in a current of clean air. The feathers can be adjusted during drying. Any dirt which had adhered to the fat will blow away as dust. Cornmeal, used as an absorbent in the preparation of skins which were later cleaned by this method, fell out of the plumage like sand, or was carried off by the air blast.

This apparatus can be made of copper, if a large number of skins are to be cleaned, and it can then be of considerable size and the extraction chamber packed with specimens. If made of copper, the top of the extraction chamber and condenser should be removable. The joint where the cover with condenser attached joins the extraction chamber must be gas-tight. In the copper apparatus there should be a pipe provided with a stop-cock connecting the bottom of the extraction chamber with the distillation flask. The stop-cock should be closed during the extracting, but can be opened to drain the ether from the extraction chamber before the chamber is opened. In using a metal apparatus, the length of time required for complete extraction of the fat will have to be judged by experience. In the glass apparatus, the color of the solvent in the extraction chamber indicates when the extraction is complete.

All skins must be dry before being subjected to this process. If it is necessary to relax a skin before extracting, dry it temporarily in a shape to fit the extractor, extract it, relax after ether has evaporated and set again.

Newly made skins known to be greasy can be treated as soon as dry. The ether does not relax the skin in the slightest degree. Some arsenic may be washed from the skin by mechanical action, but sufficient will be left to render the bird-skin safe from insect attacks.

The use of such other solvents as petroleum ether, gasoline and carbon tetrachloride for extracting fat can be experimented with to advantage, using this apparatus.

The author has used this method on the following specimens, with the result recorded. After treatment, the specimens were

compared with duplicates and the color of the plumage was normal in each case.

Ægialitis semipalmata. Semipalmated Plover, Toronto, Canada, 1905.

Condition. Greasy and dirty, the feathers stuck together with fat; discolored, dusty.

Result. Entire plumage clean, feathers beneath, fluffy and white.

Charadrius dubius dubius. Philippines, 1909.

Condition. Mouldy, greasy and stained with blood.

Result. Entire plumage clean, breast feathers which were exposed to air still rusty, ones covered by wings perfectly white.

Limonites ruficollis. Japan, 1895.

Condition. Dirty, breast greasy and yellow.

Result. Entire plumage clean and fluffy breast almost free from yellow.

Pelidna alpina. Scotland, 1873.

Condition. Practically in the last stages of fatty decomposition; feathers hard.

Result. Clean and free from grease, feathers soft.

In order to determine whether or not this solvent had any decolorizing effect, a series of experiments was made. A number of hummingbird skins were immersed in ether for one and one-half hours, dried and compared with duplicates; a number of feathers were taken from bird skins, immersed in ether for one and one-half hours, and compared with feathers from the same area on the bird-skin from which they were taken; and a number of larger feathers were cut in two, one half immersed in ether for one and one-half hours and compared with the untreated portion of the same feather. The tests were made with a view to variety in color. The results are summarized below.

EFFECT OF IMMERSION IN ETHER ON FEATHER PIGMENTS.

SPECIES	PORTION	COLOR	EFFECT
Chrysolampis mosquitus	Whole	Iridescent red and gold	None
Selasphorus alleni	"	Iridescent scarlet orange	"
Selasphorus rufus	"	Iridescent scarlet orange	"
Petasophora cyanota cabanidis	"	Metallic green and metallic blue	"
Munia maja	"	Various browns	"
Piranga erythromelas ♂	Back feathers	Scarlet	"
Piranga erythromelas ♀	Side of breast feathers	Yellow	"
Melopsittacus undulatus	Upper tail covert feathers	Green	"
Dendroica fusca	Breast feathers	Orange	"
Chlorophanes spiza exsul	Back feathers	Metallic blue green	"
Sporophila corvina	Secondary	Jet black	"
Setophaga ruticilla	Side of breast feathers	Orange salmon	"
Phœnicurus phœnicurus	Rump feathers	Rufous brown	"
Tanagra cana	Half primary	Blue edging	"
Stoparola melanops	Half secondary	Blue	"

CONCLUSION.

The method given will absolutely remove fat from bird-skins. Damage caused by decomposition which has already occurred cannot be remedied, but an application of this method will stop all further decomposition due to fat. By removing dirt adhering to the grease, the true colors of the plumage can be seen and studied.

Valuable specimens, type specimens and specimens of extinct species can be protected by this process and will have their existence assured for a much greater period of time.

My sincere thanks are due to Mr. J. H. Fleming for providing specimens for the work and for deciding whether or not color changes occurred as a result of the action of the solvent.