

or water. "At Simla within 1½ hours of (after?) sunrise currents of 6 to 10 feet a second are common at heights of only 20 feet above tree-clad slopes facing the sun." At Agra a rather crude recording instrument, set on a tower 45 feet above the ground, on sunny days "indicated ascending currents beginning shortly before the upward gliding of birds and ending shortly after this had ceased."

It is stated that the "alula" type of wing has been successfully introduced in airplane design, its tendency being to reduce the angle of descent in gliding. This point, in the opinion of the reviewer, the author has insufficiently developed.

Contrary to some theorists, a steady horizontal wind is as useless in gliding as a perfect calm. But winds are constantly changing in velocity and direction. Calculations are introduced to show that the requisite energy for soaring may be derived from successive gusts of wind. This is regarded as a sufficient explanation of what Hankin calls "wind soarability" in the absence of sunshine. Also Rayleigh's theory of energy derived from a progressively increasing wind velocity with gain of altitude may occasionally suffice to explain gliding; at least it is a "useful auxiliary." In the case of gulls circling about the stern of a steamer, calculations are introduced to show that the differential wind velocity astern affords an adequate source of energy for this type of gliding.

In general, however, ascending currents are regarded as the source of energy of soaring flight. The author states: "During the past 7 years I have not seen a bird gliding upwards in a region where, from physical causes, descending currents could be expected; and in most cases ascending air has been strongly indicated."

The paper is concluded with a review of certain inaccuracies and discrepancies in Hankin's work, from the point of view of physics and mechanics, and mention of certain items of observation in which Walker cannot concur.

Most students of flight have felt that Hankin took insufficient account of known physical laws in arriving at his conclusions, and will appreciate this timely criticism, which is at the same time a contribution to our knowledge of soaring flight, clearly and concisely expressed. One lapse occurs on page 372, where the fact that kites and vultures

have difficulty in gliding at low altitudes is invoked as evidence that the ascending currents are stronger at higher altitudes, although the latter has previously been postulated in explanation of soaring.—ROBERT C. MILLER, *Department of Zoology, University of California, January 3, 1924.*

HANKIN ON THE FLIGHT OF GULLS.*—

By an odd coincidence, in the same number of the journal containing the above mentioned criticisms of his work appears another paper by Hankin in which further startling conclusions are set forth. When a steamer is under way, it is stated, some gulls may glide in the ascending currents to windward, while others soar in a "soarable area" to leeward of the stern. In the windward ascending current gain of height is gradual, with the axis of the body horizontal. But in the soarable area to leeward of stern the case is said to be very different. The gain of height is rapid, steep upward glides of 50 or more degrees occurring, "commonly to the level of the top of the stern flag-staff."

Gulls in the soarable area are further characterized by the appearance of a faint color on the wings. "The underside of the wing of a soaring bird often shows a power of reflecting color which power is usually absent when the bird is gliding with loss of height or in an ascending current of air."

But most surprising of all, the soarable area was found to be in the region of a *descending* current of air, as demonstrated by trailing strings astern, throwing grass overboard, and observing the behavior of smoke from the funnels. *Ascending currents were avoided.* If a gull happened to get into an ascending current, it was forced to flap until it regained the descending current, when it could again soar easily. The author also observed gulls soaring "in the probable position of descending gusts of wind" to the leeward of Gibraltar and Aden. In the latter case it was noticed that the wings of the gulls showed a bluish tint; but three minutes later, when the birds were gliding in an ascending current, the undersides of their wings appeared white. "Thus the evidence goes to show that near sea-level, as a

* Soaring flight of gulls following a steamer, by E. H. Hankin. Proceedings of the Cambridge Philosophical Society, vol. 21, pp. 426-429.

rule, gulls can only soar in a descending current of air."

While one hesitates to negative another's statements of observation, Hankin's findings in this, as in other cases, are certainly at variance with those of most students of flight. Apart from the admission that gulls sometimes glide in the ascending current to windward of a steamer, there is scarcely a statement in this paper in which the reviewer can concur. It is unfortunate that the details given are so few as to preclude the possibility of a reinterpretation of the data. Specific statements as to wind and weather are lacking. The position and extent of the soarable area under varying conditions are only vaguely indicated. "The level of the top of the stern flagstaff" is a somewhat indefinite statement of altitude. It is not clear what occurred after the gulls had glided to this height, whether they remained there a minute, or five minutes, or immediately dropped astern to repeat the performance. So complex are the air currents in the wake of a steamer that such statements of observation have little value, except as they describe in detail the behavior of individual birds under the most carefully analyzed conditions.

As regards changes of color, if any, during flight, these would appear to be of aesthetic or optical rather than aeronautic interest. But it is decidedly important to determine whether ascending or descending currents are utilized in soaring. No explanation is hazarded as to why the descending current should be preferred. Apparently the object of this paper is to support the author's previously expressed belief that soaring flight is a "complete mystery." The reviewer, who has elsewhere committed himself to the cause of those who find in ascending currents of air a sufficient explanation of soaring, will require further evidence to the contrary before reversing his opinion.—ROBERT C. MILLER, *Department of Zoology, University of California, January 3, 1924.*

CHAPIN'S GUIDE TO "THE PREPARATION OF BIRDS FOR STUDY."—Not in a long time has there come to my attention so useful a manual as the present one dealing with the preparation of bird skins. The author, Mr. James P. Chapin, is well-known as a pains-taking and otherwise successful field ornithologist, by reason

particularly of his several years' work in Africa for the American Museum of Natural History. In the present contribution Mr. Chapin brings together the results of his own experience and, doubtless also, that of his several practiced associates on the staff of that long-established institution.

An especially helpful feature of this guide is the abundance of illustrations. These leave practically no step in the procedure of bird-skinning which is not clearly and even artistically demonstrated. Just where certain cuts are to be made, stitches to be taken, and the tendons seized for removal from the tarsi, the location and appearance of the sex organs, and the nature of the "windows" in immature skulls, are among the points illustrated.

This is Guide Leaflet No. 58, issued by the American Museum of Natural History, and we note that it can be obtained from the Librarian of that Museum, Central Park, New York City, for fifteen cents—a merely nominal sum for a 45-page manual of such obvious value. Every field collector, no matter how well he thinks he knows his technique, will be sure to profit by studying it; and for beginners I can recommend nothing better.

Some points that Chapin makes and that appeal to me as especially worth heeding are as follows: Powdered arsenic (in mixture with alum in damp climates) is by all odds the best preservative, and, "with ordinary care" in its use, "it offers no danger to the health of the collector." Do *not* plug the nostrils of a freshly taken bird, for the pressure may change their form, which it is important to preserve. Do *not* use plaster of paris as an absorbent, as it leaves an undesirable "bloom" on dark-toned plumages. Tie the mandibles together so that the bill remains closed as it does in life; "a well-closed bill is essential to a good skin." Do *not* strip the secondary wing quills from the ulna; leave them attached to the bone, in normal order.

There is only one point in the whole thing that I would criticise adversely, namely, the implication that there should be a "collector's label" briefly inscribed, on a temporary tag, affixed to specimens in the field, in lieu of the regular museum label to be added later. This is a serious matter, and I would urge, rather, that a permanent label, made out *fully* (save for the scientific name of the species) *by the collector, in the field* at the time the specimen is prepared, be