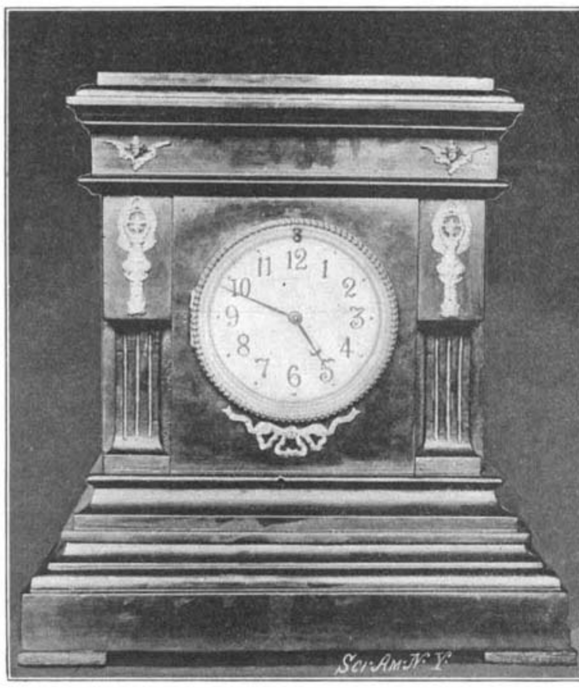
SELF-WINDING CLOCK.

BY DAY ALLEN WILLEY.

A simple winding mechanism for clocks has recently been perfected whereby a clock may be periodically wound by the action of an electro-magnet on an armature connected with the clock weight. In our illustration the connecting link *A* is weighted, and serves as the driving power for the clock movement. The link is secured at its upper end to an arm on the armature *B*. At the lower end it is connected to the lever *C*. A spring pawl on this lever engages a ratchet wheel, and the weight of link *A* serves slowly to rotate the wheel, which in turn operates the clock mechanism. When the weight drops to its lowest position, a pin on the lever *C* engages a bell crank *D*, which in turn lifts a latch *E*, out of engagement with a shoulder on lever *F*, permitting the latter to drop forward to the right. This movement brings the upper end of the lever *F* directly under a pin projecting from an extension of the escapement anchor of the clock. On the first swing of the pendulum toward the right, this pin is rocked downward, depressing the lever *F*, and lever *G*, on which it is mounted, and making an electric contact at *H*. The circuit of battery *K* through magnets *M* is thus closed. The magnets cause the armature *B* to swing on its axis, lifting the weight to its initial position. The contact at *H* is, of course, immediately broken on the return swing of the pendulum, and the parts are allowed to drop back to their normal positions. From five to eight minutes is required for the weight to reach its lowest position. In the ordinary-sized mantel clock, such as that illustrated, a battery of three dry cells is employed. These are placed in a drawer beneath the clockwork, and serve to wind up the clock for a period of about eight months without renewing. This system is also applicable to clocks with long pendulums, such as the cathedral type, the mechanism being, of course, proportionately larger and the magnets and battery more powerful.



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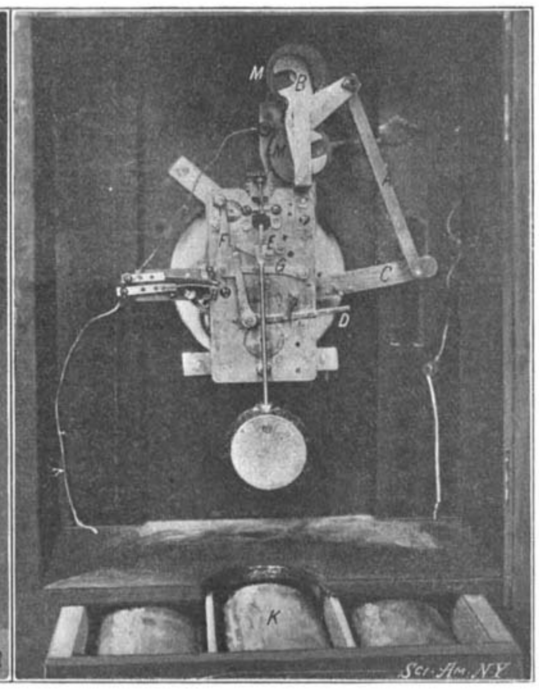


VIEW SHOWING DETAILS OF WINDING MECHANISM.

THE ACTION OF A BIRD'S WING AND ITS BEARING ON THE PROBLEM OF MECHANICAL FLIGHT.

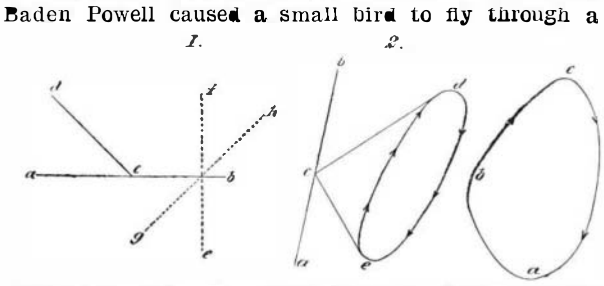
BY DR. T. BYARD COLLINS.

The precise action of a bird's wing is so difficult of observation that a close scrutiny has been persistently attempted only during comparatively recent years.

It has been shown that the muscles of a man are not adapted to the propulsion of wings, though the experiments of Lilienthal revealed some astonishing facts, as, for instance, that vibrating wings, of moderate size and of a certain form and structure, actuated by a kind of treadmill contrivance, could be made to lift half their own weight plus half the weight of the operator. This is the more interesting in view of the fact that almost at the same time these results were being obtained, and that with an apparatus admittedly crude and excessively heavy, a reputable engineer was demonstrating mathematically that a man-operated pair of wings, in order to lift the weight of a man, would have to have a surface of some acres in size. But while human flight with man-actuated wings attached to his body is highly improbable, the solution of the great problem by other means is now believed to be possible by the most competent thinkers on the subject.

The sailing and soaring birds have been profoundly studied; and, while there is no universally accepted theory as to the manner in which their wonderful phenomena are produced, it is still hoped by many that they may be imitated, and that some form of aeroplane or air-runner will eventually be evolved which will fulfill the demands of aerial navigation.

As bearing upon the same fascinating subject, the action of the wing of the bird in flight is being somewhat more carefully considered. Some years ago a writer for the Encyclopædia Britannica declared that the telling stroke was downward and forward, and that if it were otherwise, the bird would be pitched a somersault by its own activity. Prof. Hargrave asserted that a bird's wing revolved in a cone and acted as a modified trochoided plane. Prof. Pettigrew was the first, so far as I know, to try for a self-recorded diagram of a wing in action. For this purpose he used a sphygmograph, but his efforts seem not to have been very successful. Baden Powell caused a small bird to fly through a paper tube, the tube being smoked on the inside surface. When the tube was cut longitudinally and spread out, there were marks upon it from which Major Powell felt warranted in calling attention to the wing's alternate flexion and extension. Zanvrie remarked the change in the angle of incidence taking place in the course of a complete vibration, but, to this observer, the up and down strokes were delivered vertically.



a, b, the bird's body; *c, d*, the wing at the beginning of the down stroke, showing the upward, forward, and outward angle assumed. The dotted lines *e f* and *g h* represent the vertical and lateral axes of the body.

a, b, the bird's body; *c, d*, extreme reach of wing at moment of beginning the down stroke; *d, e*, line of descent, throughout which the wing is being flexed; *e*, extremity of down-stroke; *e, c*, shortest distance from the tip of wing to point of attachment.

Showing a possible modification of the ellipse when the wing is contracted not progressively, but suddenly when the down stroke has been practically completed; *c, a*, representing the down stroke, *a b* the line of contraction, and *b, c*, the upward stroke.

DIAGRAMS SHOWING THE ACTION OF A BIRD'S WING.

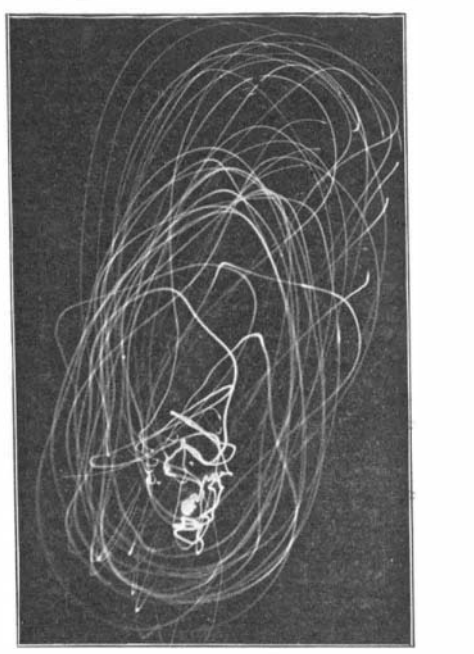


Fig. 3.—THE RECORD OF MOTION.

For the purpose of either correcting or verifying some observations of my own, a common pigeon was held lightly in hand and moved suddenly so as to induce efforts at flight. During these movements, flashlight photographs were secured from which, together with a record of motion, some deductions were subsequently drawn.

A pigeon was selected because it was considered a representative bird for the purpose. It weighed 15 ounces and its wings were each of 12 inches reach and 5 inches wide at the base. In flight they assumed nearly the form of a triangle, so that their total surface was, approximately, 60 square inches.

The record of motion was obtained by leading fine insulated wires from a battery to a small incandescent lamp, which was fastened to the tip of the wing. The bird was then induced to make efforts at flight as before stated, and the moving wing with the light attached was exposed, in a darkened room, to a photographic plate through the lens of a camera. The lamp was loosened and finally beaten off by the violent motion of the member, this fact also appearing in the record, where the lines become irregular and heavy, the moment of detachment being marked by a final blot.

It is not claimed that a perfect record was obtained. Allowance must be made for the conditions under which the bird acted. Still, the transcript is legible, and that is, after all, the vital factor in an experiment of this kind.

Studying then the upper portion of the tracing, for the record is here more accurate than elsewhere, it would appear that, if the tip of the wing were to continue in the same plane, relatively to the vertical axis of the bird's body, throughout a complete vibration, it would describe an ellipsis upon the plane. But, while this complete vibration is being made, there is also a retraction and extension in the reach of the wing, as noted by Baden Powell, the flexion being indicated by the dip of the lines toward the left, or by their complete break, the tip being cut out of focus by some intervening portion.

At the beginning of the down stroke, the wing, extended to its utmost reach, assumes, relatively to the bird's body, an angle upward and forward of something like forty-five degrees, as shown in Diagram 1. It should be mentioned in this connection that the wing has not only the power of extension and flexion due to the movement of its joints, but the extent of surface exposed may be greatly modified from moment to moment by the opening and closing of the feathers upon themselves. Always in full flight, at the beginning of the down stroke, the greatest possible spread is exposed to the resistance of the air.

When alighting, the bird assumes nearly an erect posture, as any one may verify for himself by watching a pigeon alight in the street, and beats its wings *downward and forward*, and it is only when alighting that such movements are performed.

In Fig. 1 the wing has nearly completed its down stroke, and the point to be noted is the angle of incidence which it was making at the moment the camera caught it, an angle so small that but little of the surface is seen, giving the wing the appearance of disproportionate narrowness.

In Fig. 2 the plate was, by mistake, exposed twice and to different views. It is reproduced here because it was found impossible with the facilities at command to

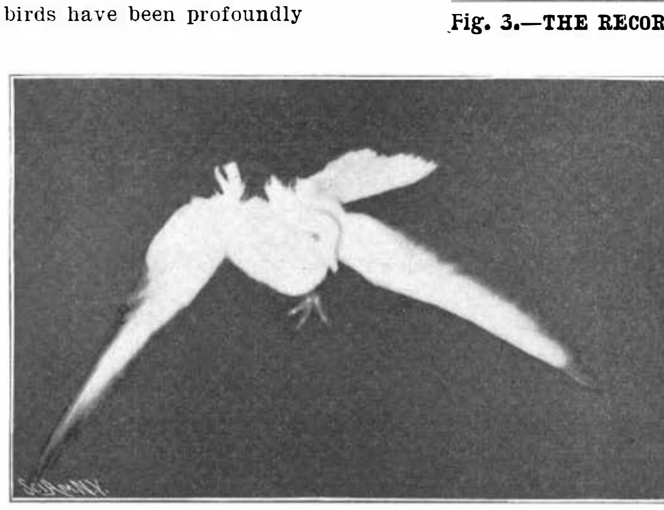


Fig. 1.—SHOWING THE ANGLE OF INCIDENCE WHEN THE WING HAD NEARLY COMPLETED ITS DOWN STROKE.

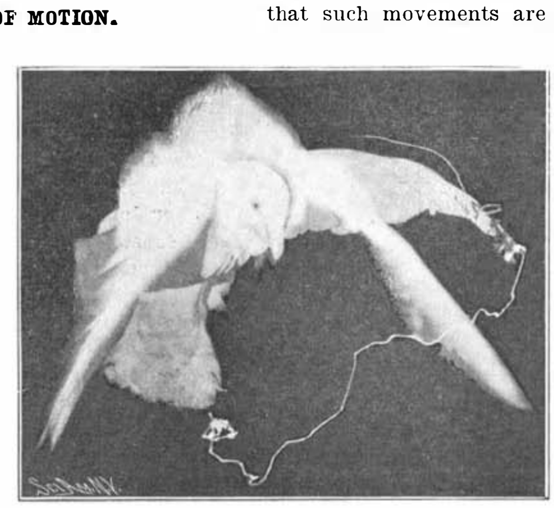


Fig. 2.—SHOWING THE WING AT THE INSTANT OF BEGINNING THE UP STROKE. ALSO THE EXTENDED WING WITH THE LAMP ATTACHED.

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