

INSECTS' WINGS—RAPIDITY OF VIBRATION IN FLIGHT.*

We should be decidedly remiss if in the study of this interesting insect we failed to investigate his means and powers of flight. His very occupation necessitates some rapid means of locomotion, and with this nature has abundantly endowed him. So great are their powers of flight that bees have been known to gather honey from buckwheat fields (a favorite pasturage) seven miles from their nearest possible habitation.

Not only are they capable of flying with great speed, but of carrying loads when on the wing which seem incredible.

Very often during the annual slaughter of the drones (the males, as before explained) have I seen a "worker" drag his victim, at least once and a half his own weight, from the hive, and after one or two efforts as if to secure and properly balance his load, sail lightly away and drop his burden only after going a long distance from the hive.

When we consider the difficulty of a person carrying a proportionate load, though sturdy of limb and with earth for a footing, we can realize the difficulty encountered by an insect with only the air for his support.

Nor is flight the only function of these useful members; they are equally indispensable in what might be termed the commonest drudgery of the household.

It must be borne in mind (notwithstanding the old rhyme) that bees do not make honey, they only gather it; and very rarely is it found in the nectaries of flowers in proper consistency to store for winter use. Falling dews and rains dilute it until, if stored in that condition in their warm hives, it would soon be vinegar, for which they have no use in their domestic economy.

Bees even gather, with great avidity, the maple sap from troughs in the "sugar bush," many gallons of which must be boiled into one to reduce it to keeping consistency. Their labors are therefore but half performed when the liquid has been collected; it must

tight hive, I felt like apologizing to the toilers for my slanderous thought, and was impressed anew that "they also serve who only stand and wait." So rap-

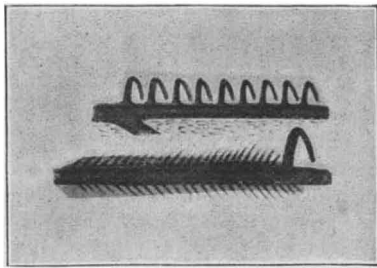


Fig. 1.—HOOKS FOR COUPLING THE WINGS OF THE BEE.

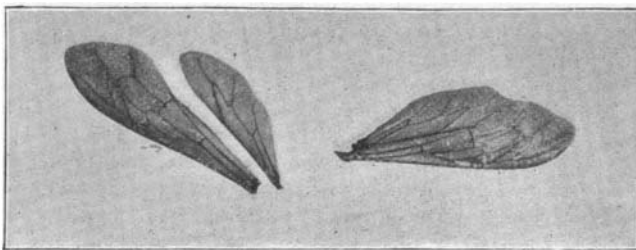


Fig. 2. WINGS OF THE BEE (ENLARGED).

idly does the evaporation progress that when a hive is placed on scales to note the daily increase, it is found to weigh materially less in the morning than on the previous night.

The structure of the wing consists of a thin, transparent membrane stretched over a delicate framework of horn-like substance, essentially like those of the common fly, with which we are, alas! only too familiar. Unlike the fly, however, which belongs to the order Diptera, or two winged insects, the bee has four, a pair on each side. When closed they overlap upon the back, enabling the bee to enter flower cells unobstructed by his wings.

Unlike the butterfly and other four winged insects, the bee is provided with means by which the wings on either side may be coupled together, to secure unity of movement and greater efficiency in flight. The means provided is a row of twenty-one hooklets, a few of which are shown greatly enlarged in the accompanying cut.

These hooklets, attached to the anterior rib of the posterior wing, are so placed as to engage the hindmost rib of the forward wing, and thereby render the two one in effect, as seen upon the right in the next view; and yet quickly disengagable (as seen at the left) for overlapping when occasion requires (see cut No. 2).

In addition to this unity of action on either side there is also operative connection between the wings on opposite sides, though I am unable to state how it is effected. That it exists is proved by the fact that if the wings

on either side be moved up and down, artificially, those on the opposite side will move in unison with them, though the bee may have long been dead.

The bee's wings are proportionately small in comparison to other insects—some butterflies of the same weight having perhaps ten times the area of wing. The lack of wing surface is more than compensated for, however, in rapidity of vibration, otherwise such intensity and strength of flight would be impossible.

Having a bee tethered by a strand of fine sewing

cotton around his waist (so to speak), that is between his thorax and his abdomen, I was struck with the strength of the little creature, as indicated by the strain upon the thread, whether afoot or on the wing.

With my little captive thus restrained, and contemplating the rapidity of wing movement necessary to produce such appreciable strain, I was impressed with a desire to know exactly the number of vibrations per minute, and following the impulse I am pleased to say I succeeded beyond the possibility of doubt.

While I realize that should I tell you I had counted them and that they sometimes exceed 15,000 per minute, and that I also have the certificate of the bee to the same effect, you would accuse me of treading, at least, on the borders of romance, yet I trust I shall be able to convince you that both assertions are practically true.

To effect this purpose I employed the running gears of a clock; and substituting a longer shaft for that which carries the minute hand, erected thereon a wooden disk surrounded with a two inch band of highly polished tin, thereby forming a short cylinder 18½ inches in circumference, which, controllable by a specially constructed governor, was revolvable at any speed within reasonable requirements.

When thus arranged, the cylinder was revolved slowly above a smoking lamp until so coated as to have the appearance of black velvet. It was found that this coating could not be thrown off by the highest speed obtainable, and yet that it adhered so lightly that a hair passed over it would leave its

tracery upon the tin. With the cylinder rapidly revolving, a bee with his six legs held in light forceps, but with wings free and struggling to escape, was brought carefully near the revolving surface. At first contact the track was swept clean, leaving no evidence of the frequency of his strokes, and showing that increased velocity of the cylinder must be resorted to. After tiring out many bees, re-covering the cylinder many times, and finally increasing its speed to 120 revolutions per minute, I was rewarded with many wing-engraved records, one of which is shown in the accompanying cut (Fig. 3).

In this case the wing tracks seen upon the cylinder were precisely seven to the inch, which number, multiplied by 18½ (the number of inches in circumference),

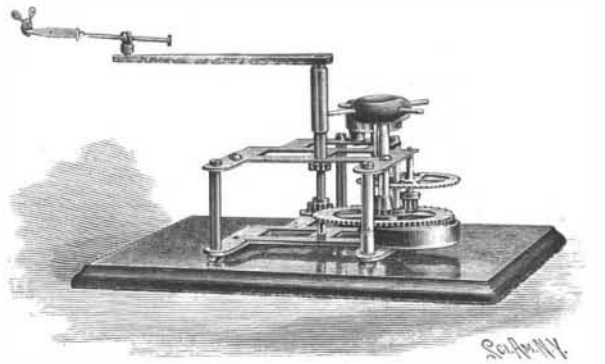


Fig. 4.—BEE MOUNTED ON REVOLVING LEVER.

and that by 120 (the number of revolutions per minute), gives the highest result inscribed upon the tablet on the cylinder, the results having been inscribed after the experiments were completed, the lowest number given being the record made by the bee, who, having become exhausted, was making but slight efforts to escape.

The certificate of the bee, to which I have referred, might be interpreted thus:

I hereby certify that when in flight I sometimes vibrate my wings at the rate of 15,540 strokes per minute.

Signed (pointing to the wing tracks)
his
APIS a MELLIFICA.
mark.

While these results were entirely satisfactory and conclusive, yet, while pursuing the experiments, foreboding failure, I conceived yet another plan, which, from its very fascination, I was impelled to carry out, and which, though falling very slightly short of the highest record, yet virtually corroborated the results obtained by the former process.

Removing the cylinder, I substituted therefor a wooden lever or "hand," so to speak, which, with the apparatus standing upright, would revolve as the hand of a clock, and fitted the outer end to receive the stage forceps of the microscope.

When thus arranged, the legs of a lively bee were caught within these forceps, and thus pinioned, he was laid, back down, upon a surface covered with very tenacious glue and then another covered with thinnest gold foil cut into small squares, and there held until one of same adhered securely to his wing.

When thus caparisoned, the forceps were attached to the outer end of the lever and the bee was ready for his flight (see Fig. 4). This picture was taken, however, after the

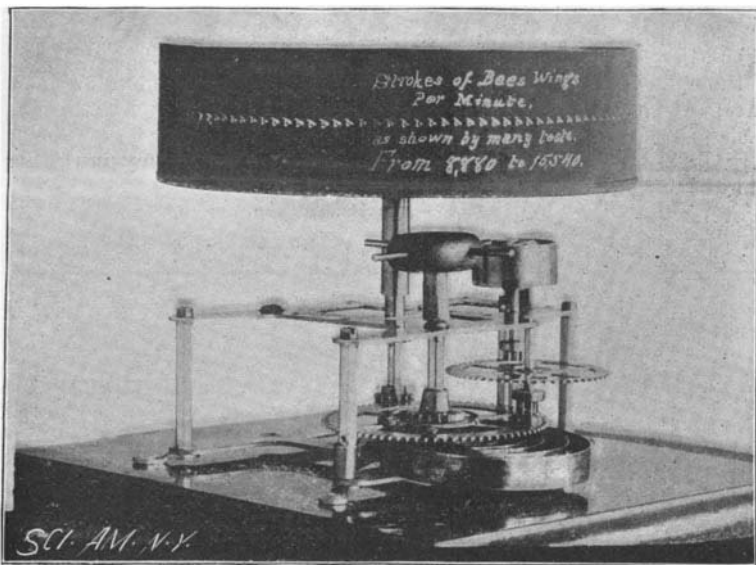


Fig. 3.—WING STROKES OF BEE AS RECORDED ON SMOKED CYLINDER.

be "boiled down," so to speak, and the wings are the only means by which that toilsome process is performed.

Visit the hives in the honey making season when you will, night or day, and you hear the incessant hum of their tireless wings.

As in the absence of blotting paper you sometimes blow upon the newly written page to promote evaporation, so by the vibrations of their wings the bees pass air currents over the honey to accomplish the same result. Never until honey is thus "ripened," to use the phrase of the beekeeper, will the cells be sealed or "capped" for winter use.

The wisdom manifested in inducing these air currents is often readily apparent. The entrance to a hive kept in my attic, for observation, consisted of a glass covered passage (between the hive and the window sill) about fifteen inches long by twelve wide and one-half inch high. During the honey making season the floor of this passage was often so obstructed with idle bees as to impede the passage of their more industrious fellows. When it was observed, however, that the wings of these "idlers" were always in motion, so rapidly in fact that each clung to the floor to prevent flight, and that all on one side faced one way while those opposite faced the other, thereby producing air currents in opposite directions through the same passage, and with the co-operation of those within, through the otherwise nearly air

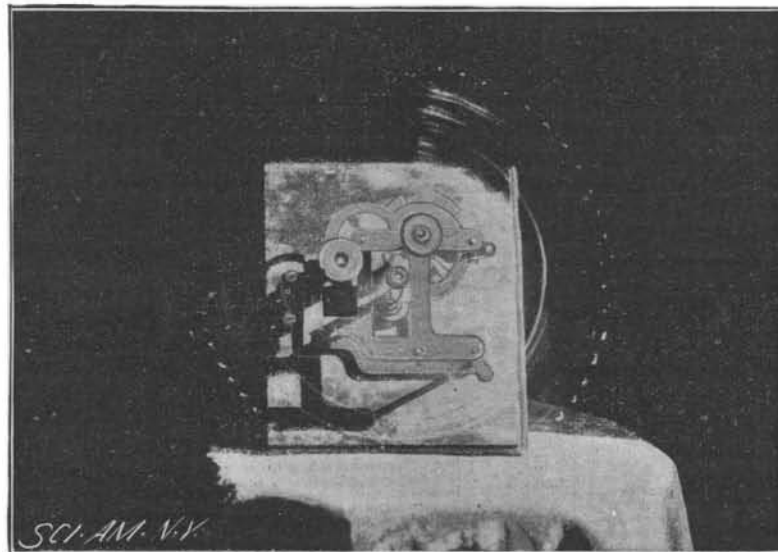


Fig. 5.—HORIZONTAL VIEW OF APPARATUS SHOWN IN Fig. 4, SHOWING SCINTILLATIONS OF THE WINGS.

*Extract from an illustrated lecture delivered by Aurelius Steward, of the Bridgeport, Conn., Scientific Society, at Cooper Union, New York, upon the subject of "The HoneyBee."

bee had fulfilled his mission, and, thoroughly exhausted, had ceased struggling to escape; the object being merely to show the arrangement of the apparatus and the gold tipped wing of the insect.

The theory was that a bee thus equipped, if photographed in the bright sunlight while in motion, might throw flashes of light into the camera, which, on account of the advancing movement, falling in different places, might be counted upon the plate.

The "snap shot" of the camera was so arranged that the exposure would be only about three-quarters of one revolution, that there might arise no confusion by passing more than once over any part of the track.

I confess to many failures. Many tests were made and the pictures developed, only to discover that the bee had "left no sign."

At last, as a freshly captured subject made the circuit, his track was seen to scintillate, and on developing the picture the result was at once apparent, as plainly shown on the screen. (See Fig. 5.) At each vibration he had thrown into the camera a wingful of sunbeams. The insect and rapidly moving parts of the apparatus show only in dim, shadowy outline, but in his flight, with gold tipped wing clipped in sunshine, he has inscribed his record on the sensitive plate as unmistakably as if graven in stone.

Early Mediterranean Culture.

The address of Mr. Arthur J. Evans, president of the Anthropological Section of the British Association this year, is peculiarly rich in new facts and suggestions, says Prof. D. G. Brinton, in Science.

He returned but a few months since from his third archaeological exploration of the island of Crete, and brings back with him ample evidence of the intimate contact of the natives of that island with the culture of Egypt probably as early as 2500 B. C.

No doubt the rays of this primitive insular civilization shone athwart the middle sea to the isles of Greece and the northern shores. But not on them alone did the wise of the race depend. Mr. Evans points out that the Mycenaean culture of pre-Homeric days probably sprang from roots which we must seek in the soil of Anatolia, in that Aegean art which developed in the favored vales of Phrygia and Lydia.

Other questions, of broader scope, are also touched upon by Mr. Evans. Dismissing the "glamor of the Orient," rejecting the orthodox notion that the primitive Aryan was some sort of a "patriarchal missionary of Central Asian culture," he declares for the greater probability that what the Aryan knew he had learned by study on the spot, and that his lineage is to be traced in European or "Eurafrican" surroundings,

from far back into the darkness of paleolithic times. Even then, in that rude and distant period, he was not of the brutes, brutish; for Mr. Evans relates an unpublished find of a surface burial, dating from Quaternary times, where the corpse had been laid in a position of decent repose, the shell knife, the deer's tooth ornaments, and the paint pot by its side.

The Recovered Classic.

The British Museum has once again the satisfaction of announcing the recovery of one of the lost classics—an announcement which will be welcomed by all but school boys, and need not, in point of fact, greatly disturb even their enjoyment of the Christmas holidays. Previous discoveries of the same kind have given us back authors from the later periods of Greek literature, Hyperides, Herodas, Aristotle. In the present instance it is one of the great lyric poets of the earlier days, Bacchylides, the nephew of Simonides, the contemporary and rival of Pindar, who is thus, in part at least, restored to us. The manuscript containing these precious relics of ancient literature is a papyrus recently discovered in Egypt. So far as the writing is concerned, it is in very good condition, being handsomely written in rather large uncial characters on papyrus of fine quality; but, unfortunately, the manuscript has suffered severely at the hands of its native discoverers, and is torn into many fragments. The date of the manuscript is probably in the first century before Christ. It will be the work of much time to bring the fragments into their proper order, and even when this is done, it is almost certain that much will be seen to have been lost; but, with due allowance for mutilation, it remains true that a substantial addition has been made to the extant treasures of Greek literature. Hitherto Bacchylides has been known only through the references of ancient writers and a handful of quotations, the longest being a graceful fragment of twelve lines in praise of peace. The lyric poetry of early Greece falls into two classes, which may be distinguished as personal and festal. Of the former, the main theme of which is love, with all the attendant joys and sorrows of the individual singer, the great representative is Sappho, with Alcæus and Anacreon in her train—all, alas! still waiting for the happy discovery which shall make them fully known to us. In the second class the great name for us is Pindar; but with him the ancients classed two other poets, Simonides and Bacchylides. All wrote the same kind of poetry, the common characteristic of which is that it celebrates some occasion of festivity or solemnity, such as hymns of triumph, dirges for

the dead, chants to be accompanied by dances, and especially poems in celebration of victories won at the great games of Greece, the Olympian, Pythian, Isthmian, and Nemean festivals. It is of songs such as these alone that complete examples are extant, in the great odes of Pindar; and the newly recovered poems of Bacchylides belong to the same class of composition. It is too early as yet to say how many poems are contained in the new manuscript; but there would seem to be parts, at least, of some fifteen or twenty, varying in length from fourteen to about two hundred lines. The former might be held sufficient for some comparatively obscure victor, or for one who required a short chant for immediate use in prompt celebration of his success; the latter was needed when the patron was such a one as Hiero, the great ruler of Syracuse.—London Times.

Unreliable Popular Weather Proverbs.

Many persons still fail to realize the fact that the weather proverbs which pass down from generation to generation, as unquestioned as are the nursery stories, belong to what maybe properly called mythology, says the Monthly Weather Review. Like the myths and legends of ancient times, they may, possibly, have had some slight basis of fact; they may possibly have applied satisfactorily to some far off period and some far distant land, or to one special occasion, but do not necessarily hold good to-day and in their own country. At a recent meeting of the Meteorological Society of France the members discussed the popular proverb: "When it rains on St. Medard's day it will rain for forty days unless fine weather returns on the day of St. Bernabe." M. Teisserenc de Bort showed that M. Lancaster, who several years ago examined this question, found no results tending to verify this saying. M. Teisserenc de Bort has also studied the question as to whether it was possible to predict in advance a rainy period; thus in examining the data collected from 1863 to 1896, he finds that in the first days of June the rain is, on the average, a little more abundant, and diminishes toward the end of that month. But it was not observed that there was any systematic grouping of the days of rain around the day of St. Medard.

M. Renou said that M. Elie de Beaumont has called attention to the fact that the proverb relative to St. Medard dates from the middle ages, and that since then the order of the saint's days in the calendar has been changed, and that now the day of St. Gervais is the one to which the proverb should be applied. M. De Beaumont, therefore, examined the question of the grouping of days of rain according to the new date, but did not find any verification of the proverb.

RECENTLY PATENTED INVENTIONS.

Mining, Etc.

TREATING ARSENIC ORES.—Gustaf M. Westman, New York City. This invention provides a process and apparatus for obtaining from the ores treated metallic arsenic, and separating and saving the precious metals they contain. The ores are melted by an electric current, one of the electrodes in the circuit being a stratum of lead beneath the ore with which the precious metals unite while molten, the arsenical vapors given off from the melted ore being condensed simultaneously with the precipitation and union of the precious metals with the lead. The construction is such that a number of charges may be treated in the furnace before removing its lead bottom containing the precious metals and substituting a new one.

ABSTRACTING PRECIOUS METALS FROM ORES.—John P. Schmitz, San Francisco, Cal. A box or casing in which are horizontal strainer plates is, according to this invention, filled nearly full of quicksilver, and the crushed ore, placer ground gravel or sand, is forced upward through the quicksilver by compressed air, the precious metals uniting with the quicksilver and the other ore or sand being blown away from its top, through a side opening in the hood covering the casing. Hot melted lead may be used instead of the quicksilver, the precious metals then uniting with the lead to form an alloy, which may be drawn off through a pipe at the bottom of the casing.

Agricultural.

THRASHING MACHINE ATTACHMENTS.—Asahel W. Eddy and Harvey P. Jones, Coleridge, Neb. A simple and economic device is provided by these inventors for the distribution of the straw and grain to the cylinder of a thrashing machine, and for cutting the bands of the bundles. The blades of the band cutter and feeder are of spiral construction, all the cutters standing at different inclinations, and when the material is piled up high on the conveyors the tendency is to separate the upper layers. The improvement is designed to facilitate the more rapid operation of the thrasher, the grain being distributed uniformly for presentation to the concave and cylinder.

FERTILIZERS FROM GARBAGE.—Lawrence Manuel, Newport, R. I., and Pliny Catucci, New York City. For the better disposal of garbage, etc., producing therefrom a useful filling for fertilization, these inventors have devised an apparatus having a pit from which leads a conveyor feeding to a disintegrator which empties into a second pit. An elevator, inclosed by a casing, rises from the second pit and extends to a digester which empties into a third pit communicating with a pump by which a filter is fed. The contents of the digester are boiled for a specified time and the gases are conveyed away, while the solid matter in the digested material retained in the pockets of the filter press may be used as a fertilizer.

EGG TESTER.—Henry F. Walton, Flan-dreau, South Dakota. This inventor has devised an egg examining apparatus comprising a box with transparent top, and in which are reflectors, a lamp holder being adjacent to openings in the box, and there being in the box sliding tables, a rack, etc. The eggs may be transferred from the receptacles in which they are packed to the testing tables, where one or more entire layers may be simultaneously tested, the bad eggs removed and replaced by good ones, and the tested layers then replaced in the case from which they had been taken, the entire work being done with a minimum of breakage.

Miscellaneous.

MOTOR VEHICLE.—Lewis Brown, Saw-kill, N. Y. For use either as an ordinary road wagon or as a light passenger vehicle, this inventor has devised a motor carriage in which a motor of any preferred form is arranged under the rear part of the bed to be completely out of sight and out of the way. The gearing between the motor and the driving axle is very light and simple, and by a steering gear of novel construction the vehicle may be readily turned without excessive straining of the parts, the steering gear lever being within ready reach of the driver. An effective brake is provided, and the entire construction is designed to be simple and inexpensive.

BICYCLE TIRE.—Margaret A. Sancho, Brooklyn, N. Y. This tire is composed of a series of balls arranged continuously within a circular frame fitted in the grooved portion of the usual tire rim, the frame being segmental in cross section and having a removable section through which balls may be introduced should one or more of them become punctured and need to be replaced. The balls are held in place only by the curvature of the frame, whose side edges extend slightly beyond the center of the balls. A tire thus formed presents less surface friction than the ordinary tire, is designed to be especially advantageous in ascending steep grades, and is non-collapsible as a whole.

BICYCLE CRANK CONNECTION.—George Wilson, Madelia, Minn. A novel means of connecting the crank arm with the driving shaft, which has been designed by this inventor, possesses lightness, strength and durability, with great convenience of adjustment. The shaft has a substantially triangular stub end, and there is a corresponding hub on one end of the crank arm, there being grooves in the walls of the hub apertures to receive splines on the stub end of the shaft. The crank arm is locked on the stub end of the shaft by means of a wedge block and key bolt or by a set screw.

ACETYLENE GAS GENERATOR.—Guy S. Archer and Charles F. Burrington, Cherokee, Iowa. This invention comprises an apparatus in which a holder with open lower end extends into a water tank, the holder carrying a suspended calcium carbide receptacle, and automatically rising and falling to generate gas in proportion as the latter is withdrawn from the receiver.

The gas leaves the receiver in a comparatively dry state, from passing through an air space in the upper part of the holder, and is cooled by passing through a pipe which extends vertically through the water tank. The gas can be shut off for any length of time without danger.

FLOWER POT HOLDER.—Hosea Waterer, Philadelphia, Pa. This holder has an upper portion to receive the flower pot, and communicating with a base or reservoir adapted to hold any superfluous water draining off from the pot until it may be conveniently removed. In the lower, or reservoir portion, is a removable support of peculiar construction forming a rest on which the flower pot is held.

INKSTAND.—Charles S. King, Cross Fork, Pa. This inkstand has a rocking stopper crossing the ink well, and automatically closing the well after the pen has been withdrawn, the stopper being pivoted and moving when the point of the pen is applied to allow the pen to enter the ink.

TROUGH.—John S. and Joseph B. Weaver, New Oxford, Pa. The body of this trough is semicircular, of sheet metal, and into each end is fitted a head preferably made of cast metal, and held in place on the top by a band shrunk onto the exterior surface of the body and the top of the head, forming a water-tight joint. The top edges of the trough are preferably protected by bent strips of sheet metal, thus strengthening the edges and removing the liability of stock being cut thereon.

VESSEL STEERING GEAR.—William Tuttle, Natchez, Miss. According to this invention the steering wheel, having the usual spokes, turns around an annular, ring-like support upon which is journaled a spindle provided with a drum adapted to carry the steering cable, and there is a rack and pinion connection between the spindle and the wheel. The improvement forms a simple and inexpensive connection between the wheel and the rudder, whereby the latter may be quickly and conveniently operated with a minimum of exertion, the proportions preferably being such that the drum will be giving about eight revolutions for one revolution of the steering wheel.

LANDING NET.—Allan Holmes, Dunedin, New Zealand. In this improved device for the use of anglers the net-holding frame is adapted to be collapsed and folded along the handle for carrying and to be extended and locked in position for use, the change of form and position of the frame being produced by a swinging movement, and the locking and release of the locking devices being automatically effected by gravity. The frame is constructed of jointed segments pivoted to swing as a whole about a center pin fixed to a supporting and locking disk or head, in combination with pivoted pawls on the members and notches in the disk or head to receive them.

INHALER.—Hareey M. Dunlap, Battle Creek, Mich. An improvement in the cushioned sur-

faces or margins of inhaling cups or masks is provided by this inventor, the cushion consisting of an air tube provided with a vertically and transversely slotted attaching section to receive the marginal portion of the article to be cushioned. The cushion thus formed is elastic and pliable, and readily adapts itself to the face. It is easily removed for cleaning or disinfecting, or a number of persons, each having a separate cushion, may use the same instrument.

SURGEON'S SYRINGE.—Frederick Eissner, New York City. This is a syringe in which the several parts are arranged to be quickly and conveniently disconnected to permit of thorough cleaning and rendering the syringe aseptic. The barrel is preferably of glass, and the plunger is provided with a cylinder of rubber or other elastic material stretched over annular ridges on the reduced threaded end of the plunger stem, forming a very tight fit of the plunger in the barrel. The plunger stem passes through an elastic disk forming a stuffing box at the outer end of the barrel.

IRONING BOARD, BENCH AND LADDER.—William G. Rodgers and Charlie E. Kuhn, Johnstown, Pa. This is a combination device of simple and inexpensive character, which may be used as a bench to support tubs and other articles and as a stand for an ironing board and a rack for supporting clothes, the rack being so constructed that it may also be used as a ladder. The ironing board may be raised at one end to be inserted in a garment, and the device, when not in use, may be folded up and stowed away in small space.

KNIT FABRIC.—Thomas J. Woodcock, Philadelphia, Pa. To provide a fabric especially designed for the body portion of hammocks, but which may also be used wherever a strong knitted material is required, according to this invention, the warp threads are arranged in two sets, one in rear of the other, the threads being in serpentine lines, with the bights of the two sets turned in opposite directions and overlapping bights of adjacent threads of one set of warps being connected by one set of the knitting threads, and bights of adjacent threads of the other set of warps being connected by the other knitting threads. The material has but little tendency to ravel if punctured or torn.

INVALID BED.—James T. Hall, Monticello, Ark. This invention provides an improvement on a formerly patented invention of the same inventor. The frame or bedstead is preferably made of metal rods and has a central fixed section and upper and lower tilting sections, a lever being pivoted to the central section and links or rods connecting the lever to the tilting sections. A bath tub is designed to be fitted in position to give the patient a foot bath without removing him from the bed, and the upper bed section may be conveniently raised and held at any desired inclination.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co. for 10 cents each. Please send name of the patentee, title of invention, and date of this paper.