Locusts in the Red Sea.

A GREAT flight of locusts passed over the s.s. *Golconda* on November 25, 1889, when she was off the Great Hanish Islands in the Red Sea, in lat. 13°·56 N., and long. 42°·30 E.

The particulars of the flight may be worthy of record.

It was first seen crossing the sun's disk at about 11 a.m. as a dense white flocculent mass, travelling towards the north-east at about the rate of twelve miles an hour. It was observed at noon by the officer on watch as passing the sun in the same state of density and with equal speed, and so continued till after 2 p.m.

The flight took place at so high an altitude that it was only visible when the locusts were between the eye of the observer and the sun; but the flight must have continued a long time after 2 p.m., as numerous stragglers fell on board the ship as late as 6 p.m.

The course of flight was across the bow of the ship, which at the time was directed about 17° west of north, and the flight was evidently directed from the African to the Arabian shore of the Red Sea.

The steamship was travelling at the rate of thirteen miles an hour, and, supposing the host of insects to have taken only four hours in passing, it must have been about 2000 square miles in extent.

Some of us on board amused ourselves with the calculation that, if the length and breadth of the swarm were forty-eight miles, its thickness half a mile, its density 144 locusts to a cubic foot, and the weight of each locust $\frac{1}{16}$ of an ounce, then it would have covered an area of 2304 square miles; the number of insects would have been 24,420 billions; the weight of the mass 42,580, millions of tons; and our good ship of 6000 tons burden would have had to make 7,000,000 voyages to carry this great host of locusts, even if packed together 111 times more closely than they were flying.

Mr. J. Wilson, the chief officer of the *Golconda*, permits me to say that he quite agrees with me in the statement of the facts given above. He also states that on the following morning another flight was seen going in the same north-easterly direction from 4.15 a.m. to 5 a.m. It was apparently a stronger brood and more closely packed, and appeared like a heavy black cloud on the horizon.

The locusts were of a red colour, were about $2\frac{1}{2}$ inches long, and $\frac{1}{16}$ of an ounce in weight. G. T. CARRUTHERS.

A Marine Millipede.

IT may interest "D. W. T." (NATURE, December 5, p. 104) to know that *Geophilus maritimus* is found under stones and sea-weeds on the shore at or near Plymouth, and recorded in my "Fauna of Devon," Section "Myriopoda," &c., 1874, published in the Transactions of the Devonshire Association for the Advancement of Literature, Science, and Art, 1874. This species was not known to Mr. Newport when his monograph was written (Linn. Trans., vol. xix., 1845). Dr. Leach has given a very good figure of this species in the *Zoological Miscellany*, vol. iii. pl. 140, Figs. 1 and 2, and says: "Habitat in Britannia inter scopulos ad littora maris vulgatissime." But, so far as my observations go, I should say it is a rare species. See *Zoologist*, 1866, p. 7, for further observations on this animal. EDWARD PARFITT.

Exeter, December 9, 1889.

Proof of the Parallelogram of Forces.

THE objection to Duchayla's proof of the "parallelogram of forces" is, I suppose, admitted by all mathematicians. To base the fundamental principle of the equilibrium of a *particle* on the "transmissibility of force," and thus to introduce the conception of a *rigid body*, is certainly the reverse of logical procedure. The substitute for this proof which finds most favour with modern writers is, of course, that depending on the "parallelogram of accelerations." But this is open to almost as serious objections as the other. For it introduces kinetic ideas which are really nowhere again used in statics. I should therefore propose the following proof, which depends on very elementary geometrical propositions. The general order of argument resembles that of Laplace.

I adopt the "triangular" instead of the "parallelogrammic" form. Thus, if PQ, QR represent in length and direction any directed magnitudes whatever, and, *if these have a single equivalent*, that single equivalent will be represented by PR.

To prove that the equivalent of PQ, QR is PR.

(1) The equivalent of two perpendicular lengths is equal *in length* to their hypothenuse.

For, draw AD perpendicular to hypothenuse BC.

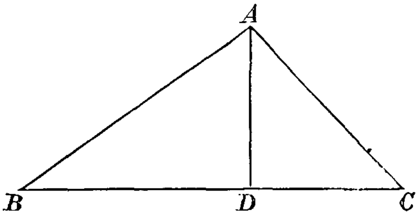

FIG. 1.

Then, let BD, DA = k . BA, making angle θ with BA towards BD.

Then, by similar triangles, AD, DC = k . AC, making angle θ with AC towards AD.

But these equivalents are at right angles, and proportional to BA and AC. Hence, their equivalent, by similar triangles, is k^2 . BC along BC.

But BD, DA, AD, DC = BC. $\therefore k^2 = 1$; $\therefore k = 1$.

(2) If theorem holds for right-angled triangle containing angle θ, it holds for right-angled triangle containing $\frac{1}{2}\theta$.

For, let ACD = θ, where D is 90°. Produce DC to B, such that CB = CA. Then ABD = $\frac{1}{2}\theta$.

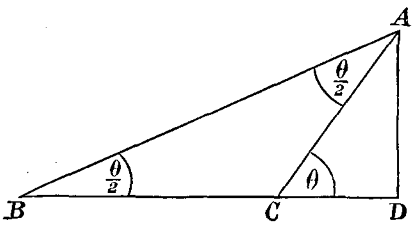

FIG. 2.

Then assume CD, DA = CA. Add BC. $\therefore$ BD, DA = BC, CA.

But BD, DA = BA in magnitude by (1); and BC, CA has its equivalent *along* BA, $\because$ BC = CA. $\therefore$ BD, DA = BA, both in magnitude and direction.

(3) If the theorem holds for θ and ϕ, it holds for $\theta + \phi$.

For make the well-known projection construction. Thus—

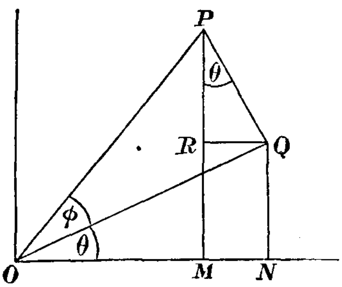

FIG. 3.

OP = OQ, QP = ON, NQ, QR, RP = OM, MP.

(4) Finally, by (1), theorem holds for isosceles right-angled triangle; $\therefore$ by (2) it holds for right-angled triangle containing angle $90° \div 2^n$; $\therefore$ by (3) it holds for right-angled triangle containing angle $m. 90° \div 2^n$: *i.e.* for *any* angle (as may be shown, if considered necessary, by the method for incommensurables in Duchayla's proof).

Hence, if AD be perpendicular on BC in *any* triangle,

$$\text{BA, AC} = \text{BD, DA, AD, AC} = \text{BC}. \qquad \text{Q.E.D.}$$

W. E. JOHNSON.

Llandaff House, Cambridge, November 12.

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