it the necessary rotation to the end of its journey. The weight of the gun is a trifle over eighty-one tuns; but it is to be known in the service as the 80-tun gun. It has been constructed of eight separate wrought iron coils, fitted and shrunk one into the other on the Fraser system.

The projectiles with which it will be proved correspond in size, but not in shape, with the shot and shell with which it will be fired on service. They have been cast in the shell foundery of the Royal Laboratory, and are great bolts of solid iron, each weighing 1,300 lbs. They are flat-headed, and filled with a great number of studs to fit the grooves of the rifling. Special rammers, sponges, and other apparatus have been provided for the proof of the gun, a truck has been constructed to carry the shot, with a special contrivance for lifting it to the mouth of the gun, and the government manufacturers of gunpowder have even provided a special powder. The powder, in its way, is as remarkable as the gun. Each grain of it is a cube an inch and a half in diameter, and the cartridge, which will be 250 lbs. of this powder, will be a large bolster, about the size of an ordinary man. It is proposed to increase the powder charge, if necessary, to 300 lbs.; but this, like the caliber of the gun and the weight of the shot, will abide the result of experiments.

Scientific American.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS.

One copy, one year, postage included.....$3 20
One copy, six months, postage included..... 1 60

Club Rates.

Ten copies, one year, each $2 70, postage included.....$27 00
Overten copies, same rate each, postage included..... 2 70

☞By the new law, postage is payable in advance by the publishers. and the subscriber then receives the paper free of charge.

VOLUME XXXIII., No. 16. [NEW SERIES.] *Thirtieth Year.*

NEW YORK, SATURDAY, OCTOBER 16, 1875.

Contents.

(Illustrated articles are marked with an asterisk.)

THE FALL RIVER STRIKE.

During the middle of last summer, the proprietors of the great cotton mills at Fall River, Mass., finding that they had a large accumulation of stock on hand, and seeing that through the general depression of values and reigning dullness in trade, it would be impossible to continue operations as heretofore, notified their working people that either a reduction of wages must be made or the mills would have to stop. The proposed reduction amounted to one ninth the price then paid for piece work. The operatives in answer declined to agree to such retrenchments, but,not wishing to precipitate any open conflict with their employers, compromised matters by taking a "vacation." The mills accordingly ceased work, and the employees have waited in idleness for the arrival of better times The vacation has now expired. The prices of the large quantities of goods woven before have not advanced,nor does there seem any likelihood of their so doing, while a loss of a million dollars is estimated to have accrued to the city of Fall River through the cessation of work. The mill owners not only, therefore, are unable to go back to old wages,but several declare heavy losses, and advocate closing of the factories for a still longer period.

The workmen, toward the close of their vacation, during which time they or the majority of them had drawn support from the unions, began to realize that,by their self-enforced idleness, they had actually lost a greater proportion of their wages than would have been the case had they accepted the reduced pay. They further saw that winter was approaching, and that the union funds were getting low, and consequently the three classes of which they were composed, the weavers. the carders, and the spinners, met together to settle on some rate of wages at which they would agree to return to work.

But when the workmen came to the factories and announced their intention of coming back to work, the employers,to their astonishment, not only declined to pay more than the reduced wages, but produced an agreement for the workman to sign preliminary to being hired, which provides: 1, that he will not belong to, or be influenced by the action of, any association which assumes to govern the rights of any person to labor for whom and for what he pleases, and 2, that, in case of his desiring to leave employment, he will give ten days' notice. In connection with this, we may mention that there is already a law in Massachusetts which holds manufacturers liable in case of the discharge of an employee without notice, except for incapacity or misconduct The operatives regarded the proposed agreement as a great injustice, and made riotous demonstrations At one time troops were under arms, threats to burn the mills were freely circulated, and strong police reinforcements were sent to Fall River from Boston. The number of operatives involved, from 12,000 to 15,000 people, added to the gravity of the crisis.

The whole difficulty hinged on the trade union question. By the discordant element which, it appears, rules in these societies, the idleness of the summer was precipitated, and by them the recent difficulties were fomented, since all accounts agree in stating that hundreds of men were ready and willing to accept the terms of the employers, but were withheld by sheer menace and personal intimidation. That for any manufacturer to refuse to employ union men is a harsh proceeding, we cannot agree. Such is already the rule in some of our largest iron and steel working establishments, and no one is injured thereby.

While we hope that the law will be vigorously enforced against all rioters, we cannot but feel a genuine sympathy for the workmen who have allowed themselves to be led into the difficulty. Their losses will be heavy and severe, and their chances of bettering themselves are palpably hopeless, for it is asserted that mills closed or mills working make little difference to the proprietors during the present state of trade ,and while such large stocks are already on hand.

The strike is now over, and all, or very nearly all, the mills have their full complements of workers, who have accepted employment under the conditions above noted. The 15,000 laborers who took part in the uprising have, through their two months "vacation," lost over a million of dollars. Such are the results of the strike.

MENDING A FIFTEEN-INCH SHAFT AT SEA.

An excellent piece of mechanical work was recently accomplished aboard the steamer Ethiopia, of the Anchor line, in

Fig. 3.

Fig. 2.

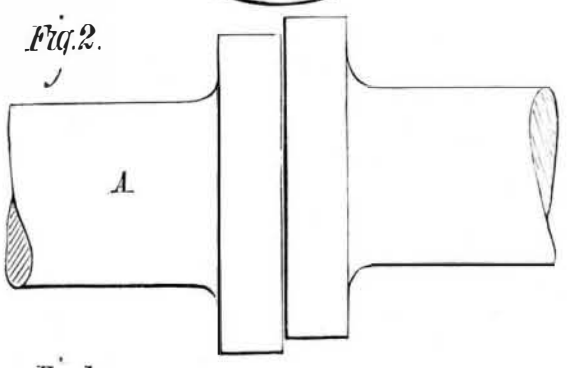
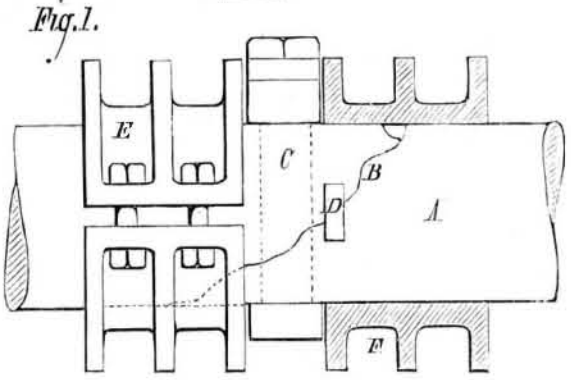


Fig. 1.



the course of that vessel's last voyage to this port. After a heavy gale, and when 1,500 miles from Queenstown, the 15-inch propeller shaft broke in a diagonal fracture. Owing to the confined space of the alley through which the shaft runs, it was very difficult to get at the break, and utterly impossible to use cranes or tackles for handling the immense weight. How the work was accomplished is represented in the annexed engraving (drawn on a scale of ¾ of an inch to 1 foot), in which A is the shaft, and B, the line of fracture. The broken parts were raised by a jackscrew, the edges smoothed, and a four inch hole bored through the opposing portions, and into the aperture a bolt, C, was tightly fitted. Four steel drivers, D, four inches long and one and a quarter inches broad, and three quarters of an inch thick, were sunk into the shaft, flush with its surface, just across the line of fracture, serving to bind the parts more closely together. Large clamps, E, were then bolted on the shaft, holding the steel drivers in place, binding the whole together tightly. A still worse difficulty presented itself in the springing or bending of the shaft. Three men, with all the power they could get out of a jackscrew, were not able to reduce the part,which was bent more than a quarter of an inch. So badly bent was the length of shaft behind the break that it was found impossible to couple them together as before, the faces of the coupling refusing to coincide, as shown in Fig. 2, by about 2¼ inches. The shaft, therefore, had to be bolted in this position; and as the old holes, Nos. 1, 2, 3, 4, 5, and 6, in Fig. 3, in the couplings would not correspond, one of the couplings had to be turned around, and three new holes, Nos. 7, 8, and 9, three inches in diameter and five inches through, had to be bored. Two of the bearings and plummer blocks under the shaft were broken, and a new support had to be devised. The work was carried on night and day and after eight and a half days, the job was complete.

To Chief Engineer Murray, of the Ethiopia, through whose skill and ingenuity the very difficult operation was accomplished, the credit of the same is due. So thoroughly was the work done that it has been deemed safe to dispatch the vessel on her return trip to Glasgow without any material alterations in the shaft and its fastening.

A DISASTROUS CYCLONE.

One of the most disastrous storms that has ever visited our coast recently swept over a portion of Texas and Southwestern Louisiana, destroying hundreds of lives and an immense amount of property. The hurricane took its rise in the Bahama Islands, and, crossing the Gulf of Mexico in a parabolic track, struck the Texan coast, curved back, and finally emerged from the Gulf at Key West, and passed off to the east in the direction of the Gulf Stream. The city of Indianola, situated about 120 miles southwest of Galveston and built on a sandy waste which slopes slightly to the water's edge, was almost totally destroyed, but five houses being left standing. In Matagorda, forty miles eastward, four houses only now remain. Velasco in Brazoria county was utterly swept away. San Bernard was completely submerged by the tremendous floods. The towns of Cedar Lake and Saliena were washed away with all their inhabitants. Morgan's Flat met a like fate. Of Lynchburg and San Jacinto but little remains; and in Galveston, enormous damages, though less than those inflicted on the other towns, were caused by the floods, which rolled over the island on which the city is located. The total loss of life is unknown, and doubtless will so remain; but the lowest estimates place it at from three to four hundred persons

Little has been positively determined regarding the cause of these cyclones. From actual observation, it appears that they may originate wherever a lower stratum of warm, moist air is rapidly elevated above the sea level. In this moist air an immense mechanical power is stored up; and when condensation caused by its elevation occurs, its moist vapor turns into rain, hail, or snow, and an influx of air from all sides rushes in to fill the partial vacuum thus formed. It has been proved that this influx toward a central regioni s immediately followed by the formation of a whirl, the subsequent development of which is due to further supplies of moist air. The cyclone then moves towards the quarter in which, for the longest time, the warmest and moistest air has been rising and producing the heaviest cloud and rainfall, and its tendency as a whole is to travel away from the equator: hence the parabolic course so plainly shown in the recent case. Applying known theories to the circumstances of the latter, there is no difficulty in accounting for the storm. The weather reports published, for the two days preceding that on which the fury of the cyclone broke upon Indianola, show warm rainy weather in the Gulf and a prevalence of strong northerly and northeasterly winds on the south Atlantic seaboard. Hurricanes have repeatedly been known to originate in Florida when a cold wind from the north has swept into the warm, moist air there prevalent, and this one is without doubt due to the same cause. The cold air elevated the warm atmosphere; and probably other circumstances being favorable, the cyclone was generated and took the course already specified. The Signal Bureau reports that the lowest barometer noted was 28·99 inches, with the maximum velocity of wind of 86 miles per hour, at the same period. The terrible effect of the hurricane may be judged from the fact that the prairies south of Indianola are literally strewn with thousands of drowned cattle, deposited by the subsidence of the floods which swept them away. Several light coasting steamers have also been found ten miles inland, left high and dry by the receding waters.

THE POSTAL LAWS---AMENDMENTS NEEDED.

Owing to increase of postage on newspapers and other transient matter by the enactment of a change in our postal laws at the end of our last Congress, it is no longer feasible for publishers to advertise their publications by mailing and prepaying postage on copies of their papers as specimens, and sending them to non-subscribers.

Last autumn we mailed several tuns in weight of the SCIENTIFIC AMERICAN to persons throughout the country, on which we paid over $5,000 postage. The circulation of the same number this year would cost for postage $7,500. We have concluded not to print an edition for gratuitous circulation this year, in consequence of this increase of postal charges.

The Post Office Department, in consequence, loses $5,000, which it would have received but for the change in the rate. This is but a small item, to be sure, to so large a department as the General Post Office, but be it remembered that this loss is from only one concern, while there are probably others who will do the same to a greater or less extent: which in the aggregate is likely to reduce the Post Office revenue very largely. It is hoped that, on the convening of our next Congress, one of its first acts will be to amend the postal law, so that the tax upon publishers and the public shall not be more oppressive than it was under the old law.

Newspaper and other publishers should commence early to agitate a reform in this matter. It will not do to take a retrograde step in the matter of cheap postage. Persons who have been in the habit of advertising in our usual special edition, referred to, are advised to avail themselves of the advertising pages of our regular edition to announce their fall business. The circulation of the SCIENTIFIC AMERICAN has never been so large at this season of the year as now, by several thousands. The number of regular subscribers at this time exceeds that of last year by over four thousand, making an aggregate issue of not less than 44,000 every week, and it frequently reaches as high as 50,000.

CONSERVATISM VERSUS PROGRESS.

Extreme opposing parties of conservatives and progressists are found in the field of Science, as well as in politics and religion. Their continual strife is mutually beneficial, each serving as a check on the other. Without conservatism, the world would certainly rush into all kinds of new theories, such as those in which men of a progressive turn of mind are very apt to indulge; while without men of progress and improvement, the world would stand still, and no advance would be possible. It is doubtful which of the two would be the more deplorable state of society.

History abounds with records of this strife between conservatism and progress: but in no field has the latter been so successful as in that of Science, for the simple reason that its triumphs, which are only to be achieved by the labor of research, are based on positive facts, which no opposition of conservatism can upset; and the benefit of this opposition consists only in the prevention of a too rash acceptance of theories, before they are sufficiently based on such facts as make them incontrovertible.

We will take a few illustrations from the fields of astronomy and geology, and remind the reader that there was a time when the whole human race considered our earth to be flat, and to consist of three connected continents--Europe, Asia, and Africa—with some islands in the inland seas, and many others surrounding the continents, all being situated in a boundless ocean, the limits of which were unknown, and their investigation seriously dreaded. The ancient astronomers who announced the rotundity of the earth were not believed, especially when contradicted by the theological priests, who then, as well as later, arrogated to themselves the enforcement of any peculiar doctrines which best suited their self-interest. But ultimately progressive Science prevailed, and conservative theology had to acknowledge that it had been in the wrong.

Next came the doctrine of the motion of the earth. The history of the persecution of the great Galileo is of so comparatively recent a date that, looking at the progress of the present day, it is almost incredible that only two centuries ago the everlasting and important truth of the earth's motion was denied, and condemned as ungodly, by the whole Christian priesthood, Protestant as well as Roman Catholic. But notwithstanding that this good man was compelled, when weakened by age and persecution, to swear to the falsehoods of the priests, the truth has been demonstrated, and progressive Science was again victorious over conservative theology.

Afterwards—toward the end of the eighteenth and beginning of the nineteenth century—came the doctrine of the great antiquity of the earth; while the accumulating evidences of its existence for millions of years, gathered by the then young science of geology, compelled all clear-minded and well informed persons to reject the popular idea, which we inherited from the Mosaic theology, that the whole earth was scarcely 6,000 years old, and was made in six days. As the evidence of the rocks proved that millions upon millions of years have elapsed during its transformation from a highly heated globe to its present condition, the better informed theologians did not combat the scientific conclusion; but the less informed priests, not worthy of the name of theologians, attempted some show of resistance to this phase of progress. But the time of persecution had passed, and priestly influence had been curtailed; so that this opposition was comparatively feeble, and utterly unable to stay the diffusion of the truth.

Still the idea that at least the human race was only about 6,000 years old was adhered to, and theologians made a kind of armistice, surrendering the theory of the six days of creation, and admitting the possibility of a creation and development lasting for millions of years, while still maintaining that 6,000 years was the antiquity of the human race. Unfortunately for them, about fifty years ago facts commenced to accumulate, proving that man has existed at least 100,000 years. The discovery that a glacial epoch took place at this time, and the relation of this grand and important event to the human race, and the accumulating proofs of man's existence immediately after, and even perhaps during or before the glacial period, are sufficient to settle this point; and society no longer heeds the opinions of any theologians who deny these demonstrated facts.

But the most serious blow to Jewish and Christian orthodox conservatism is the modern theory concerning the primitive condition of man. All the geological records found tend to show, more and more, that the first existing men, instead of having fallen from a perfect condition, had improved from the lowest state, and that the first man was a perfect savage, such as we find nowadays in some of the isolated islands of the Australian archipelago, where, for want of conflict, there was no cause for progress, the inferior men not being exterminated by the superior, a destructive process to which much human improvement is due. Progressive Science teaches that the modern civilized and enlightened society has slowly been developed from a primitive savage and ignorant condition.

The final strife of the present day, closely allied to the last mentioned theory of the continual improvement of mankind, is the evolution theory, now carried to its furthest extent. It ascribes the origin of man not only to an inferior human race, but to still lower types, now extinguished: nay, even ascribes the origin of all living beings to a single original type or even cell. It does not teach that man descends from a monkey, as the enemies of progress falsely accuse the evolutionists of maintaining, but that man is closely allied to the whole animal creation, as proved by comparative anatomy, by embryology, by the geological record, and even by psychological and ontological researches, and studies of the mind and instinct of animals, coming thus to the conclusion that the past man may have as well been evolved from a lower prototype as have been created out of dirt. Human pride is perhaps generally at the bottom of the opposition to this doctrine, as the proof of man's origin among lower beings tends, in a certain sense, to abate his arrogance; but on the other hand, man may be proud of what his race has accomplished in a short period of time, if in the beginning he sprang from a condition so low.

THE FAIR OF THE AMERICAN INSTITUTE.

To any one unconversant with machinery, we can readily imagine that the performances of an apparatus which throws out bundles of

KINDLING WOOD,

neatly tied, at the rate of 400 per hour, must be a source of considerable astonishment; and hence the expression of wonder, which comes over the face of the throng which is constantly gathered about the machine, while amusing to contemplate, is quite to be expected. To gather an idea of this curious device, the reader must imagine four horizontal bars arranged as spokes, placed equidistant about a rotating hub. Each bar has at its extremity a circular vertical frame, of a depth equal to the length of a stick of kindling wood. In each frame or cylinder works a follower, moving outward. An immense hopper filled with the sticks is provided with three openings, at each of which a boy is stationed. Boy No. 1 fills the frame nearest him loosely with wood. The bars then rotate so as to bring that frame opposite boy No. 2, whose business it is to pack in more sticks, so as to make the bundle a little tighter; then boy No. 3, when the same frame reaches him, shoves in the little sticks which complete and wedge the bundle tight. Of course, as fast as one frame departs from each operator another takes its place, and the operations above described are repeated. After leaving boy No. 3, the frame comes opposite a rod controlled by mechanism from the center, which pushes the bundle out of the frame and between a pair of vertical semi-circular jaws which come together, tightly compressing the bundle. Then a piece of annealed iron wire is led from a reel through a pair of small vertical clamps, and pushed from underneath up into the jaws, the inner periphery of which it follows, thus encircling the bundle. The end comes back to the clamp, between which a central piece then rises, grasps the wire, twists the ends together, and a knife at the same time cuts the wire off. By this time another bundle has arrived, which pushes the now tied bundle out of the opening jaws, and takes its place to undergo the same fastening. The machine is really a study for the mechanic. One gear wheel in particular, which communicates motion to the frame bars and at the same time operates the knife cam and the wire-twisting device, is a remarkable example of adaptive ingenuity. The inventor, Mr. F. Myers of this city, tells us that the apparatus easily accomplishes the work of fifteen boys, and runs ordinarily at the rate of 4,000 bundles per day of ten hours.

Another novel machine is one for

MAKING WIRE FENCE,

an inexpensive and excellent form of enclosure, which deserves to be popular among farmers. The wire, led from a series of reels, is brought up and under two sets of vertical hammers, the latter actuated, one set at a time, by cam mechanism. The uprights which support the wire are of wood, and are laid, one at a time, on the projections of endless bands, which carry them under the wire and beneath the hammers. Under the first row of hammers are guides which conduct copper staples, one at a time, over each intersection of wire and post. Then the first hammers fall and drive the staples partially in, and the second hammers, as the fence is carried along, deliver their blow and complete the insertion. There are six wires, and the pickets are four feet in length. The fence can be made with 15 or 30 pickets to the rod, and is usually formed in sections of ten rods each. It appears to be very strong. It is portable, and can be rolled and secured as easily as so much carpet. Farmers who use it might thus readily, on moving from one residence to another, take up their fences and transport them with their other farm appurtenances. Mr. A. C. Betts is the inventor, and he says that the machine will make 400 rods of fence per day.

AN ELECTRICAL COPYING MACHINE,

the invention of Mr. T. A. Edison, the well known electrician, is a novelty in apparatus of this description. A small battery of considerable intensity transmits its current to a pair of miniature electro-magnets mounted on the end of a pointed metal rod, which serves as a writing instrument. The magnets cause the rotation of a bit of iron, the motion of which is regulated by a minute fly wheel, and the result of the rapid interruption of the current is a series of sparks from the end of the instrument, which penetrate the paper written upon, and so convert the latter into a stencil plate of the characters inscribed. It only remains to put clean paper under that marked, and pass a roller charged with a prepared ink over the latter, to make as many copies of the writing as is desired, the ink passing through the holes made by the passage of the spark.

We have had sewing machines without number, buttonhole and knitting machines of all descriptions, but now something entirely new is added to the mechanical part of the sewing room in the shape of

A DARNING MACHINE.

Imagine, ye mothers of large families, who ruefully contemplate dilapidated socks by the dozen, after the week's washing, with visions of strained eyes and tired backs floating across your minds: imagine a little apparatus infinitely more simple than the sewing machine, which repairs the hugest darn in much less time than we can describe the operation, and far more neatly than you can do it with all your years of practice. This is what it is. Two small plates, one stationary and the other movable, are placed one above the other. The faces are corrugated, and between them the "holy" portion of the stocking is laid. Twelve long eye pointed needles are arranged side by side in a frame, which last is carried forward so that the needles penetrate opposite edges of the hole, passing in the corrugations between the plates. Hinged just in front of the plate is an upright bar, and on this is a crosspiece carrying twelve knobs. The yarn is secured to an end knob, and then, with a bit of flat wire, pushed through the needle eyes. Then the loop between each needle is caught by the hand and hooked over the opposite knob, so that each needle carries really two threads. Now the needles are carried back to their first position, and, in so doing, they draw the threads, which slip off the knobs through the edges of the fabric. A little push forward again brings the sharp rear edges of the needle eye against the threads, cutting all at once. This is repeated until the darn is finished, and beautifully finished it is. The inventor is Mr. O. S. Hosmer of Boston, and we predict for him the blessings of the entire feminine community. The cost of the machine is but ten dollars.

A NEW ELECTRIC MOTOR,

the invention of Mr. C. A. Hussey of this city, is at work driving a sewing machine. The engine, which is quite small, is operated by five Bunsen cells, and its movements are controlled by a simple device by connecting or disconnecting a greater or less number of elements. The machine is driven at the rate of 560 stitches per minute. Mr. Hussey's engine combines several new and excellent improvements, mention of which lack of space just at present compels us to defer to another issue.

SCIENTIFIC AND PRACTICAL INFORMATION.

AMERICAN COMPETITION.

United States hardware producers do not seem inclined to limit their competition with English manufacturers either in this country or in foreign markets by offering American made goods. When these cannot be sold in England at a good profit, current action of individual firms seem to point to the probability of United States makers starting manufactories upon our own shores. Messrs. Hussey, Binns, and Co., of Pittsburgh, have during the past twelve months been making —but only since last spring been selling—what they term a "plain black solid cast steel shovel." Their patent consists mainly in combining the iron straps with the pan of the shovel when the steel is run into the mold. Shaping and shearing, and even hardening, is done mostly under the drop hammer, to the exclusion of all but a minimum of manual labor. The result is a good tool produced at a cost that leaves a profit with which even American manufacturers ought to be satisfied; but large as these profits are, they will be increased when the existing facilities of the makers are supplemented by a 24-pot Siemens furnace which is being laid down. On behalf of Messrs. Hussey, inquiries are now being made in our own hardware districts by a gentleman who has recently come to England. His report will determine the American firm whether they shall start a works in England, or offer here their process upon royalty or purchase. The inquiries are conclusive that the process can be carried on in this country at a cost greatly under that entailed in the States; and that both throughout the export and also the home market the common iron and iron-steeled goods are giving way before those made wholly of steel. The Americans have furnished our agriculturists with some excellent forks, and their axes are unrivaled; yet the English makers of edge tools keep mostly well employed. If under these circumstances, our transatlantic cousins will, at an equally moderate price, put into the hands of our navvies, our miners, and our farm laborers a shovel which shall be equally good, they have our best wishes for their success in every legitimate effort which on this side they may put forth.—*The Engineer.*

INTERNAL PARASITES OF THE HOUSE FLY.

A correspondent of *Nature* writes that he saw a small, decrepit house fly making its way across a sheet of paper, when three minute, active animals, apparently beetles, tumbled out of it; they were light brown in color and resembled *aphides* in shape, and were of about the size of a medium pin hole.