

FRENCH EXPERIMENTS ON RIVETING.¹

A STUDY of the most elementary form of connection used by the engineer may not appear to offer anything in the way of novelty or scientific value, as a contrivance at once so old and so simple as a rivet seems at first sight not likely to afford much scope for an investigation considered as a unit apart. Indeed, the chief interest has rather been in the grouping and arrangement of rivets, and the analysis of their behaviour under stress when

working fluid. Specimens of riveting obtained from various types of machines are noteworthy as showing that the shank of the rivet does not, as a rule, bear against the plates, and that eccentricity in the rivet head is common even in the most favourable circumstances. The essential difference between riveting by hand and that produced by a riveting machine is made clear by photographs of sections of rivets at different stages of their formation, the surfaces being prepared by polishing and etching in the usual way. The superficial effect of a blow, as compared with the squeeze of the pressure machine, is apparent in all the illustrations shown in the memoir.

The interesting question of the pressure required to produce the head of a rivet is taken up, and the various circumstances which influence this are the subject of much experimental study. These include the influence of temperature, the chilling of the metal by the die, the influence of the time in which the head is formed, and the effect of an excess of material in the shank, whereby waste material is squeezed up and forms a ring round the rivet head proper.

In addition, the diagrams drawn by the recording gear give precise information as to the work done on the rivet when the time of formation of the rivet-head is varied; they also show the effect of the cooling in drawing the plates together.

A detailed examination of the strength of the rivet gives special attention to the behaviour of the head and the way it ruptures under stress, and as a result a form of head is recommended having a radius of 0.86 the diameter of the rivet and a height of two-thirds the diameter.

The author, all through, has made great use of photographs of sections of pieces of material, but without magnification, and it seems possible that this side of the investigation would have yielded still more interesting results if it had included a detailed examination of the sections under the microscope.

As an instance of this, the accompanying figure shows the well-known form of punching produced from a thick plate, in which the characteristic sharp edge appears near the middle of the depth. Sections of such punchings would be well worth examining under the microscope, and, in fact, the possibilities of further research, with the microscope pressed into service, seem well worth consideration.

E. G. C.

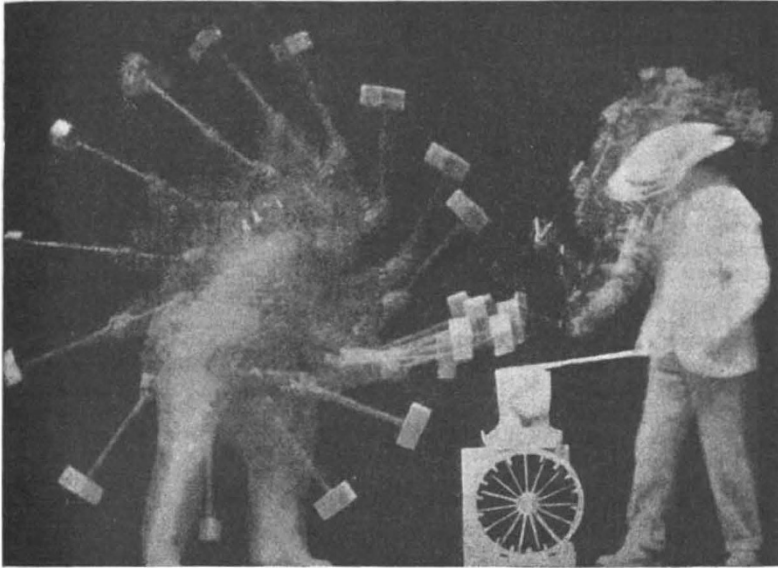


FIG. 1.—Composite photograph of a smith and striker for one swing of the hammer.

assembled in the various joints and connections used by engineers in boilers, bridges, and the like. In the present instance the author, keeping strictly to the simpler problem, has produced a memoir of great interest.

In the early pages the ordinary processes of hand riveting are described, and a series of measurements and photographs, after the manner of Marey, shows in an interesting way that the well-known preference

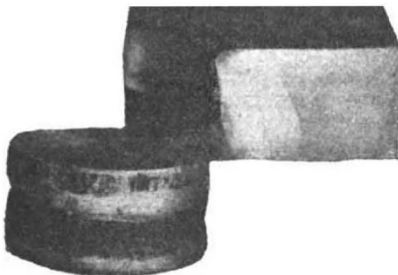


FIG. 2.—Punching from a thick plate.

of the striker for the full swing of the hammer for long-continued effort as compared with the short swing and greater number of blows is an instinctive solution of the problem of obtaining the maximum effect for the effort exerted.

The section following traces the growth of riveting machinery, and describes the characteristic effects produced when steam, air, or water is employed as the

¹ "Étude expérimentale du Rivetage." By Ch. Frémeut. Pp. 14: 183 figures in text. (Paris: Society for the Encouragement of National Industry, Rue de Rennes, 1906)

Latin and in the vernacular, of beasts and birds are constantly disfigured by printers' errors of a childish description.

So far back as 1890 a movement began in Great Britain in favour of preserving wild life in lands under British control rather than allowing it to be exterminated by ruthless shooters. To some extent this movement was inspired from the United States. The creation of the National Park of the Yellowstone district, which was to lead to the formation of a "paradise" for the nearly extinct bison, bears, prongbuck, deer, and wolves of central North America, suggested to several sportsmen-naturalists of Great Britain similar preserves in tropical lands, especially in Africa. Of course, long antecedent to that, British naturalists had at last induced the State to legislate for the preservation of the scanty remains of the British fauna, and although our measures in this respect are still woefully inadequate, and a limited and old-fashioned class is allowed to push certain forms of sport at the expense of the wild fauna of these islands, still we have saved much; and in some districts of Great Britain birds and the smaller mammals really form constant and charming features in the landscape.

The great invasion of Africa, however, which began in earnest in 1890, directed public attention to the coincident slaughter of big game which everywhere accompanied the pioneering parties of the British. Just as Great Britain had been the greatest sinner in the slave trade, and was consequently the greatest and most enthusiastic among abolitionist nations, so her people, having gone far beyond any other nationality in the destruction of wild beasts and birds, are now foremost (though the United States is running almost neck and neck) in the world-movement for the preservation from extinction of all but the most harmful animals. We are rapidly appreciating the principle that just as "man does not live by bread alone," so we cannot be contented æsthetically with beef, mutton, poultry and pheasants, with cereals, tubers and cabbages, but that to complete the interest of our lives we must have beautiful wild things around us to admire and study; there must be a niche in our society for the rhinoceros, the lion, the tiger, and even the wolf. The hippopotamus and the walrus cannot be allowed to die out completely, still less the elephant. With improved methods of travel and rapid sea transit, we want to be able to contemplate birds of paradise, alive and well, in their New Guinea setting, and not see them in women's hats. A flock of flamingoes should be looked upon as a commercial asset of real value in Mediterranean lagoons or on West Indian beaches.

The leaders of this movement in Great Britain were mostly of the "converted-burglar" type—men like Selous, E. N. Buxton, Alfred Sharpe, and Lord Delamere—who, having had glorious sport with the rifle and killed specimens of all the great or rare beasts of Africa from north to south, had gradually transferred their interest from the mere passion of pursuing and killing to the contemplation of life-habits, to the study of the living animal. Photography—especially with the telephotographic lens—was a potent agent in their reformation. Mr. E. N. Buxton especially has grown to grace, and led others with him up the pilgrims' way, through the new sport of snapshotting. An unconscious disciple of Mr. Buxton's has been Herr Schillings, whose beautiful study of wild life in East Africa ("With Flashlight and Rifle") has done much to advance the cause of game preservation in those regions. A very great share, however, in this important movement has been taken—perhaps unknown to the author himself—by Mr. J. G. Millais. His book, "A

Breath from the Veldt," published in 1895, was an epoch-making work. Many date their conversion to the new gospel from the days in which they first studied Mr. Millais's work. Though a sportsman of the truest type (and sport in this sense means far more than mere accurate shooting with rifle or gun), Mr. Millais realised himself, and taught those who gazed at his pictures, that it was far more profitable to our enjoyment and education to watch living creatures alive and study their habits with accuracy than to kill them and stuff their dead bodies.

How far the official world is in earnest about big-game preservation—in our own or any other Governments—it is difficult to say, there being so much humbug about the attitude of all Governments towards questions of art, science, and morals. Officialdom, as represented by Ministers that come and go, has taken a certain amount of tepid interest in the preservation of the African fauna. Some of the permanent officials (as distinguished from the parliamentary), like Sir Clement Hill, have displayed a praiseworthy persistency in pressing this matter on the attention of Secretaries of State, Governors of Colonies, and Commissioners of Protectorates. Sir John Kirk and the late Herr von Wissmann worked hard in the same direction. Sir Charles Eliot during his Commissionership in East Africa gave practical effect to regulations which had sometimes fallen into abeyance; the writer of this review (together with Sir Alfred Sharpe) between the years 1892 and 1901 created a number of game reserves in British Central, British East Africa, and Uganda, the reserves ranging from an area of thirty to several thousand square miles in extent.

The policy of "game reserves" has been called much into question at different times by settlers and tourists. Settlers in regions adjoining these reserves complain that the wild game harbours the tsetse-fly, or that lions and leopards stray from the area of the reserve and become dangerous to the inhabited regions outside. Tourists, especially those who are naturalists and judicious sportsmen, complain that the "game reserve" (at any rate in Somaliland and parts of the Sudan) simply becomes a "game preserve" for the military officers on duty in those regions. On the other hand, if there is no special "national park," "paradise," or region set apart for the unfettered existence of wild beasts and birds, then, as Africa becomes opened up, an almost complete destruction of wild life ensues. Regulations may be framed and printed, but to attempt rigidly to enforce them is to incur constant friction, and even serious trouble, with Europeans and natives, both of whom are more or less reckless about "shooting for the pot" or destroying any creature that may threaten their crops or livestock. It has seemed to the present writer that the only real solution of this difficulty is to create and enforce game reserves—to set aside relatively large areas here and there in Africa which are not particularly well adapted for cultivation or settlement, but which may nevertheless offer features of great picturesqueness or interest, and thus become national parks where live creatures of every description are allowed to lead an unfettered life. But, naturally, in creating these game reserves the writer has not intended that their sanctity should be infringed by anyone with a gun—official or non-official. Many specially protected beasts or specially reserved areas are relieved of protection when a very distinguished or influential applicant applies for exemption from the regulations. The present writer would have the sanctity of these reserves rigidly adhered to; on the other hand, he would not attempt to enforce too drastically the preservation of game in the settled districts outside the

reserves, though he would do everything in his power to discourage the needless killing of any beast, bird, reptile, or even insect that was not markedly harmful to the interests of man. Creatures of extraordinary beauty or interest, like the tiger, lion, moose, or elephant, should be allowed considerable latitude, and the State should compensate the cultivator or the passing tourist for annoyance because of the general interest felt by the community in the splendid development of these remarkable mammals.

The writer of this review deeply regrets that no efficient steps have been taken to create on a small scale national parks within the limits of Great Britain and Ireland for the preservation of wild life under wild conditions. He pointed out several years ago how admirably adapted for such a purpose is Achill Island, off the west coast of Ireland, a place which is fortunately still a refuge for many of the rarer and more interesting British birds.

H. H. JOHNSTON.

THE INTERNATIONAL UNION FOR CO-OPERATION IN SOLAR RESEARCH.

A MEETING of the International Union for Co-operation in Solar Research will be held in Meudon, near Paris, during Whit-week, and a provisional programme of the proceedings has been sent to those who have accepted invitations to attend. The meeting will open on May 20, when formal business will be transacted in the morning. In the afternoon it is intended that all new proposals for joint work shall be submitted to the meeting, so that members will have an opportunity of privately discussing the desirability of adopting the proposals before a final decision is taken towards the end of the week.

The mornings of Tuesday and Wednesday, May 21 and 22, will be spent in receiving the reports of the committees appointed at the Oxford meeting in 1905. It is understood that Prof. Pérot is ready to submit his measurements of the wave-length of the red cadmium line, and that his results are in such good agreement with those previously obtained by Michelson that the meeting probably will be able to adopt finally a primary standard of wave-length. Other reports deal with the observations of sun-spot spectra and the organisation of the systematic application of the spectroheliograph to solar work. A question of interest to which several members of the union have given considerable attention consists in fixing the best methods of measuring the areas of flocculi. This matter has been under consideration at some of the American observatories, as well as at the Solar Physics Observatory at South Kensington and at the University Observatory, Oxford, so that an interesting and fruit-bearing discussion may be expected. On Tuesday evening, Dr. Janssen, the president of the congress, will give a banquet to the members at the Hôtel d'Orsay, in Paris, and on Wednesday afternoon Prof. Julius will demonstrate in the physical laboratories of the Sorbonne some of his experiments on anomalous dispersion. Arrangements have also been made to visit the Observatory of Paris in the same afternoon.

It is hoped that the scientific work of the meeting will be concluded on Thursday, May 23, and an excursion to the Château de Chantilly has been arranged for the Friday. A formal business meeting on Saturday, May 25, will bring the meeting to a close.

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UNIVERSITY NEEDS AND THE DUTY OF THE STATE.

THE Chancellor and Vice-Chancellor of Oxford University have just appeared through the medium of the Press for at least 250,000*l.* to enable our oldest university to meet the demands that are made upon it by the ever-expanding requirements of modern learning. This appeal, coming so soon after a similar plea for a million and a half pounds, put forward recently by the Duke of Devonshire on behalf of the University of Cambridge, again brings into prominence the general question of the place of the university in the modern State and the duty of a Government in relation to the financial needs of institutions of higher learning.

In both cases appeals are made to the generosity of the wealthy public, and there is no suggestion that any responsibility attaches to the Government for the comparative poverty of these universities, in which Englishmen profess to feel great pride. The Oxford Chancellor and Vice-Chancellor, indeed, say of the needs of their university:—"In this country it is of no avail to look to the State for the satisfaction of those requirements; and it is to private generosity that the appeal must in consequence be made." It will be instructive to examine this attitude of mind towards one of the gravest questions confronting the nation at the beginning of the twentieth century, to analyse the appeals made in the light of recent experience, and to compare the results obtained with the experiences of university authorities in other great countries of the world.

In February last, in his letter to the public asking for a million and a half pounds for the University of Cambridge, the Duke of Devonshire reviewed the bequests, benefactions, and gifts received by the university since 1899, when the Cambridge University Association was formed at Devonshire House to promote the re-endowment of Cambridge University. From the sums received from our men of wealth the association was able to transfer to the university a total amount of 115,000*l.* In other words, during the seven years in which private generosity was being trusted to provide adequate means for the multifarious demands of a great university, an annual sum of about 16,430*l.* was forthcoming. That is to say, if private generosity could be trusted to display itself equally lavishly throughout so long a period, it would take more than ninety years to collect the million and a half pounds in which the University of Cambridge stands in pressing need to-day.

Similar particulars of a precise kind are not forthcoming in the case of Oxford, but it is, fortunately, possible to form some idea of the demands which are to be made upon private generosity to meet existing needs as enumerated by persons in authority in the university. The present appeal is for 250,000*l.*, and the letter signed by the Chancellor and Vice-Chancellor states two significant facts in connection with it. First, the ordinary university accounts for 1905 showed a balance of 5*l.* 17*s.* 6*d.*, and in 1906 there was "a further improvement, but the increased revenue is already allocated or pledged, and it is obvious that little more can be done in this way." Secondly, the constituent colleges contribute annually to university and academic purposes some 40,000*l.* An article was published in NATURE on July 6, 1905 (vol. lxxii. p. 231), in which a detailed account was given of the needs of Oxford University, drawn up by the professors and heads of departments, and in the article an estimate was made of the capital outlay and the annual income required to meet the needs