

avons admis, dans les limites des vitesses de 510^{ms} à 360^{ms} (1673-1180 f.s.) la résistance de l'air proportionnelle au carré de la vitesse; dans les limites des vitesses de 360^{ms} à 280^{ms} (1180-920 f.s.) nous l'avons admise proportionnelle à la sixième puissance de la vitesse, et nous avons exprimé, à partir de la vitesse de 280^{ms} (920 f.s.) jusqu'aux petites vitesses, la résistance de l'air par un binôme dont le premier terme est proportionnel à la deuxième puissance de la vitesse et le second à la quatrième puissance de la vitesse," &c. (pp. vi., vii.). So that Mr. Bashforth employs one single law, the cubic, and makes his coefficient vary to suit the velocity, while General Mayevski varies his law of resistance according to the velocity. But in neither case does the law of resistance admit of direct integration. Mr. Bashforth supplies this defect by extensive tables calculated by quadratures, and granting the cubic law, the results are exact. General Mayevski's integrations are approximations, and require extensive tables also. But there is no dispute as to the amount of resistance encountered by elongated shot in moving through the air. For General Mayevski observes: "Aussi pour compléter les données se rapportant aux projectiles de forts calibres, nous avons profité des tableaux des vitesses décroissantes déduites par M. Bashforth de ses expériences faites en 1868 au moyen de son chronographe; ces tableaux comprennent les vitesses de 518^{ms} à 283^{ms} (1700-930 f.s.), qui correspondent aux trajets de 305 en 305 mètres des projectiles oblongs de 178^{mm}, 203^{mm}, et 229^{mm} (7, 8, and 9 inches), et qui sont obtenues pour le cas où le mouvement des projectiles peut être considéré comme rectiligne. Nous avons calculé d'après les résultats insérés dans ces tableaux les valeurs de la résistance correspondantes à différentes vitesses" (p. 38).

Projectiles Oblongs.

Bouches à feu.	Vitesses v.	Valeurs de p'.	Bouches à feu.	Vitesses v.	Valeurs de p'.
C. de 4 ^l	ms.		C. de 203 ^{mm} ...	ms.	
C. de 203 ^{mm}	172	0'0151	C. de 203 ^{mm} angl.	329	0'0338
C. de 4 ^l	207	0'0137	C. de 229 ^{mm} angl.	332	0'0327
C. de 12 ^l	239	0'0148	C. de 178 ^{mm} angl.	334	0'0332
C. de 24 ^l	247	0'0170	C. de 203 ^{mm} angl.	337	0'0341
C. de 203 ^{mm}	266	0'0160	C. de 229 ^{mm} angl.	340	0'0334
C. de 203 ^{mm} angl.	282	0'0163	C. de 178 ^{mm} angl.	345	0'0354
C. de 229 ^{mm} angl.	287	0'0184	C. de 203 ^{mm} angl.	355	0'0364
C. de 203 ^{mm} angl.	291	0'0247	C. de 178 ^{mm} angl.	358	0'0382
C. de 178 ^{mm} angl.	300	0'0230	C. de 203 ^{mm} angl.	360	0'0384
C. de 4 ^l	302	0'0218	C. de 203 ^{mm} angl.	360	0'0393
C. de 12 ^l	304	0'0221	C. de 4 ^l	401	0'0450
C. de 4 ^l	307	0'0158	C. de 203 ^{mm} angl.	409	0'0430
C. de 229 ^{mm} angl.	316	0'0305	C. de 203 ^{mm} angl.	419	0'0433
C. de 4 ^l	317	0'0259	C. de 229 ^{mm} angl.	420	0'0427
C. de 203 ^{mm} angl.	319	0'0174	C. de 203 ^{mm} angl.	460	0'0449
C. de 203 ^{mm} angl.	320	0'0277	C. de 203 ^{mm} angl.	508	0'0440
C. de 24 ^l	320	0'0299	C. de 178 ^{mm} angl.	512	0'0443
C. de 178 ^{mm} angl.	322	0'0270			

It ought to be stated that Hutton's results for spherical shot are very good indeed for velocities above 1200 f.s., while Didion's results, intended to correct Hutton's, were not quite so good. They both failed for lower velocities. It would be interesting to have the resistance of the air to projectiles determined for velocities below 900 f.s. But very considerable difficulties would be met with if the experiments were conducted in the usual manner, for the chronograph is most effective when there is a rapid variation of velocity. In the middle of the range the screens would have to be raised to a considerable height. It would be found difficult to fire shots through them all. If the shot were fired at low initial velocities from the ordinary rifled gun, there might be considerable doubts respecting the steadiness of the shot.

Reference must be made to the collection of scientific memoirs on ballistics by the Comte de St. Robert published in 1872,¹ although they do not supply any new experimental data.

¹ Turin: Vincent Bora.

As it is found impossible to integrate the equations of motion of shot for the simple laws of resistance, of square cube, &c., it appears almost hopeless to search for an expression of the complicated law now known to hold good through a considerable range of velocities. These results would serve as tests of any theory of the resistance of the air; and if any theoretical investigations did satisfy these conditions, then we should have an expression for the resistance of the air to the shot, but it is almost certain that it would be too complicated to be of practical use. B.

A LOCAL MUSEUM

THE population of the parish of Morton, 1871, was 2,099—the chief village, Thornhill, containing about one half of the population of the parish. The parish is situated on both banks of the Nith in the North of Dumfriesshire, Scotland. Yet sparse as is the population, and remote from the great commercial centres as is the district, it is supplied with a museum which well might grace a place of far more wealth and consequence. The building was erected by Thomas B. Grierson, and the collections in the museum were formed by him. The Duke of Buccleuch granted the land on which to build, together with stone. The memorial stone was laid with masonic honours in June 1869. The building, which was from the design of a local architect, is an oblong, consisting of a ground floor and gallery. The gallery is very appropriately supported by six oaks, as brought from the forest, being among the last of the natural woods of Nithsdale.

The débris excavated for the foundation has been well utilised by forming a large mound in the surrounding garden, which is faced on all sides by an excellent collection of the minerals and curious stones of the district, and forms a suitable habitat for hardy plants. The garden contains a great variety of flowering plants, of shrubs, trees, and cryptogamous vegetation, and is laid out with considerable art. Large objects, which do not suffer waste by atmospheric causes, such as stone crosses and querns, are placed at intervals in the walks. Great prominence has been given in the collections inside the building to objects which illustrate the history of the country. These include some valuable relics belonging to the Covenanters of the seventeenth century, and to the poet Burns. The collections illustrative of the unpolished and polished stone-period are very valuable. Some beautifully wrought cells and stone-hammers have been yielded by this part of Nithsdale. The bronze and iron collections are very fair. Among the quadrupeds is a skull of the ancient ox which roamed wild less than a century ago in Drumlanrig Parks, and which belong to the same variety as those at Chillingham and Hamilton Palace, which are supposed to be the sole survivors of the ancient Caledonian Urus. Among fish there is an interesting collection, which was the gift of the late Mr. Shaw, illustrative of the natural history of the salmon, and which shows that animal in its various different stages. The late Mr. Shaw threw great light on the development of the salmon, and destroyed some popular delusions concerning it. He was a keeper in the district under the Duke of Buccleuch. The abnormal form of animals are very various, many opportunities having occurred to fill the cases devoted to these from the pastoral and agricultural district around. In the collection of fossils due prominence is given to those belonging to the strata of the south of Scotland, and the industrial departments contain specimens of the manufactures of the country. The museum is free to the public on Saturday, and open for a small sum during the week. School children are admitted along with their teachers gratuitously on application. The proprietor, Dr. Grierson, is most indefatigable in his attentions and explanations to all willing to learn from his collection of objects. The

number of persons who have been admitted for the first time since the museum was opened, July 1872, is about 4,000. There is a society in connection with the museum which meets monthly, having for its object original research. Papers have been contributed, amongst others, by Dr. Grierson, Dr. Sharp of the London Entomo-

logical Society, and Mr. Shaw, schoolmaster. Dr. Sharp gave an exhaustive account of the Colorado beetle, and Mr. Shaw illustrated, by means of large diagrams, Darwin, Lubbock, and Müller's discoveries on the fertilisation of flowers by insects.

J. SHAW

Tynron, Thornhill

THE AUSTRIAN ARCTIC EXPEDITION¹

NO doubt most of our readers have some acquaintance with the story of the memorable Austro-Hungarian Arctic Expedition in the *Tegetthoff* under the leadership of Lieutenants Payer and Weyprecht. We have at various times since the return of the expedition, upwards of two years ago, given details of the adventures of the party

and of the results obtained; in vol. x. p. 524, we published a map showing the geographical discoveries which had been made. In the work named below all who have heard anything of the expedition or who take an interest in Arctic exploration will be glad to have a complete history of its doings from the artistic and graphic pen of one of its commanders, Lieut. Payer. We venture to think that Payer's narrative is likely to take its place



The Austrian Flag Planted at Cape Fligely.

among the classics of Arctic exploration; the skill with which he has told the story of an expedition so full of strange and unexpected events, the enthusiasm and interest which mark every page, its pathos and humour, the value of the information it contains, and the attraction of its numerous illustrations, are sure to make it a permanent favourite with old and young, and constitute it an authority on Arctic matters generally.

The *Tegetthoff*, a screw steamer, expressly built for the purpose of this expedition, of 220 tons burden, fitted out for two years and a half, left Bremerhaven June 13, 1872, and Tromsøe about a month later, for the purpose of exploring the Arctic Seas in the Novaya Zemlya region. The vessel was equipped mainly at the expense of the

¹ "New Lands within the Arctic Circle. Narrative of the Discoveries of the Austrian Ship *Tegetthoff* in the Years 1872-1874." By Julius Payer, one of the Commanders of the Expedition. Maps and numerous Illustrations. Two vols. (London: Macmillan and Co., 1876.)

Austrian Count Wilczek, and, including officers and men, had only twenty-four souls on board. The ultimate destination of the expedition was not rigidly defined; they might make their exit by Behring Straits, or winter on the Siberian coast, or on any lands which they might be fortunate enough to discover. The first ice was met with in about 74° N., near the coast of Spitzbergen, and it remained with the ship more or less till the end. Only the year before, in a preliminary reconnaissance in a small sailing vessel, the *Isbjörn*, by Count Wilczek, the sea between Spitzbergen and Novaya Zemlya was found to be almost free of ice, and with a properly-equipped steam-vessel there seemed to be no obstacle to pushing northwards indefinitely. In 1872 things wore a very different aspect. The ice was entered in 74° N., and it required careful navigation to reach Cape Nassau, near which the *Tegetthoff* was overtaken by Count Wilczek in the