

AN ANCIENT LOCOMOTIVE.
BY W. F. DURFEE.

There is a general belief among mechanics that vehicles containing within themselves the means of their own propulsion are of comparatively recent origin; and the fact of the adhesion of the rims of their wheels to the earth or a supporting rail being sufficient to enable adequate power applied to the wheels to move the vehicle was a discovery of not earlier than the middle of the last century; but in this instance the writers on locomotive machines have not dived deep enough or stayed down long enough among the records of antiquity to discover the bottom facts in the history of such mechanisms.

The first locomotive, or self-moving vehicle, of which we have any account was the invention of Hero of Alexandria, who lived about 2,000 years ago. In his work descriptive of automatic or self-moving machines, there is illustrated a shrine of Bacchus mounted upon three wheels concealed within its base. Fig. 1 is an elevation of this shrine, which was crowned with a canopy, about which figures of dancers were made to move by hidden mechanism. Fig. 2 is a vertical section of that part of the shrine below the canopy, and exhibits the propelling apparatus of this ancient locomotive machine. Within the base, are seen two

of the supporting wheels; the driving wheel nearest the eye having been removed. On the axle of the driving wheels was the drum, b, about which was wound the rope, a, which passed upward through the space, t, on one side of the shrine and over the pulleys, r r, and was fastened to the

that the shrine move in a circular path: In Fig. 3 the rectangle, e, f, g, h, represents the outline of the base of the shrine; its three supporting wheels being indicated by the lines, o p, s t, and x y, the first and second being the driving wheels. If the shrine was required to move in the circumference of the circle, r, v, o, whose center is at c, Hero shows that the driving wheel nearest the center, c, must have a diameter determined by drawing the radii, o c and p c, from the extremities of the diameter of the outer driving wheel, o p, and then drawing the line, s t, through the point, n, at right angles to the common axle, a c, of the driving wheels and the length of this line defined by the radii, o c and o p, will be the diameter of the wheel required. It is obvious that the common axis, a c, of the driving wheels, o p and s t, must have an inclination in a vertical plane fixed by the diameters of these wheels. It is also necessary that the axis of the third wheel, x y, should be in the same vertical plane with the radial line, c d.

Hero also shows how the shrine can be constructed to move in straight lines at right angles to each other. Fig. 4 shows the arrangement of the wheels for this purpose, and Fig. 5 is a perspective view, showing the

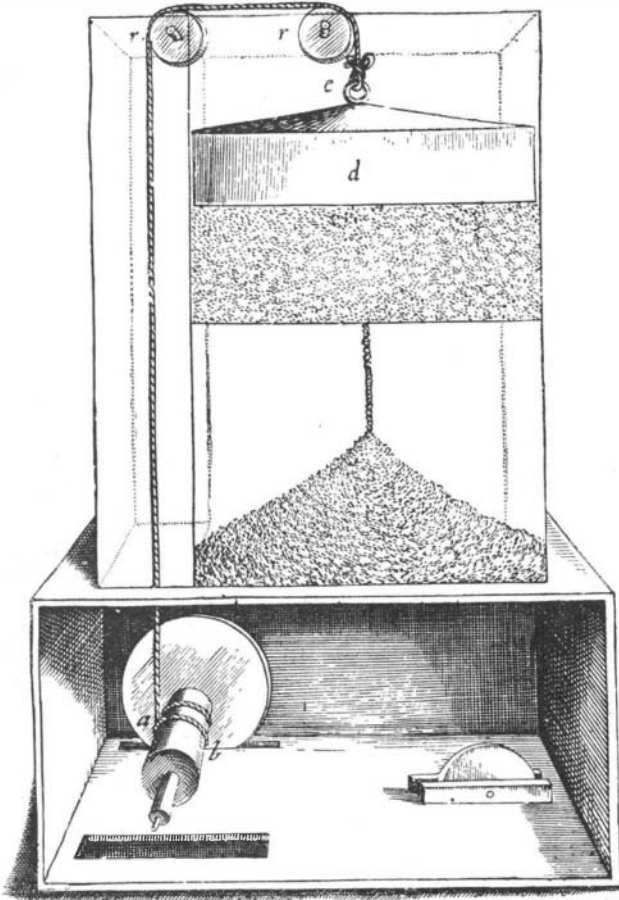


Fig. 2.—THE SHRINE OF BACCHUS—SECTION SHOWING THE PROPELLING MECHANISM.

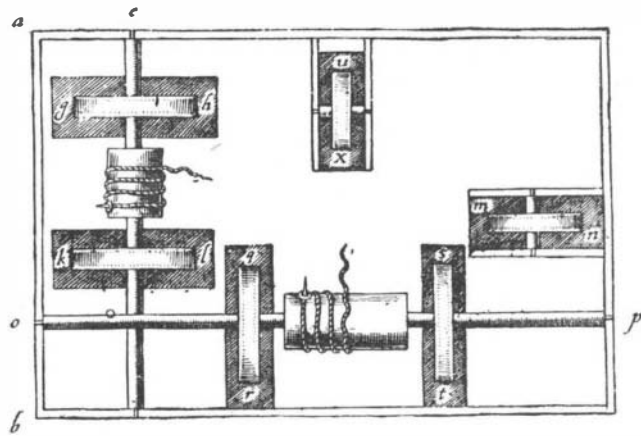


Fig. 4.

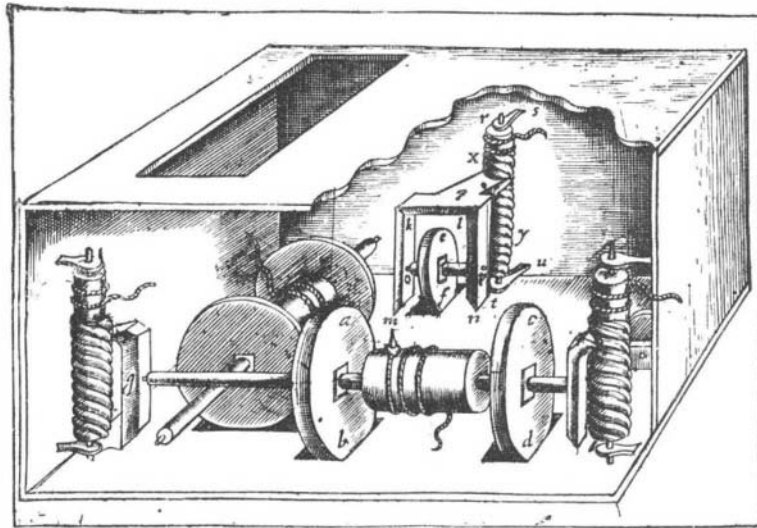


Fig. 5.

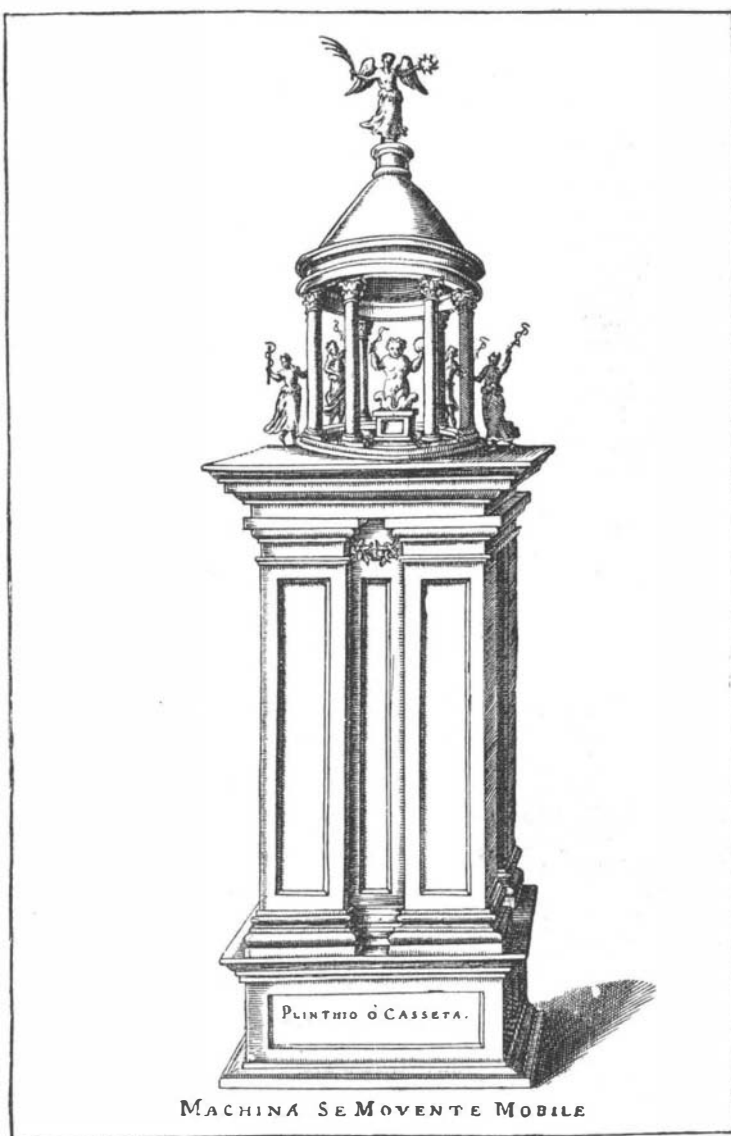


Fig. 1.—THE SHRINE OF BACCHUS.

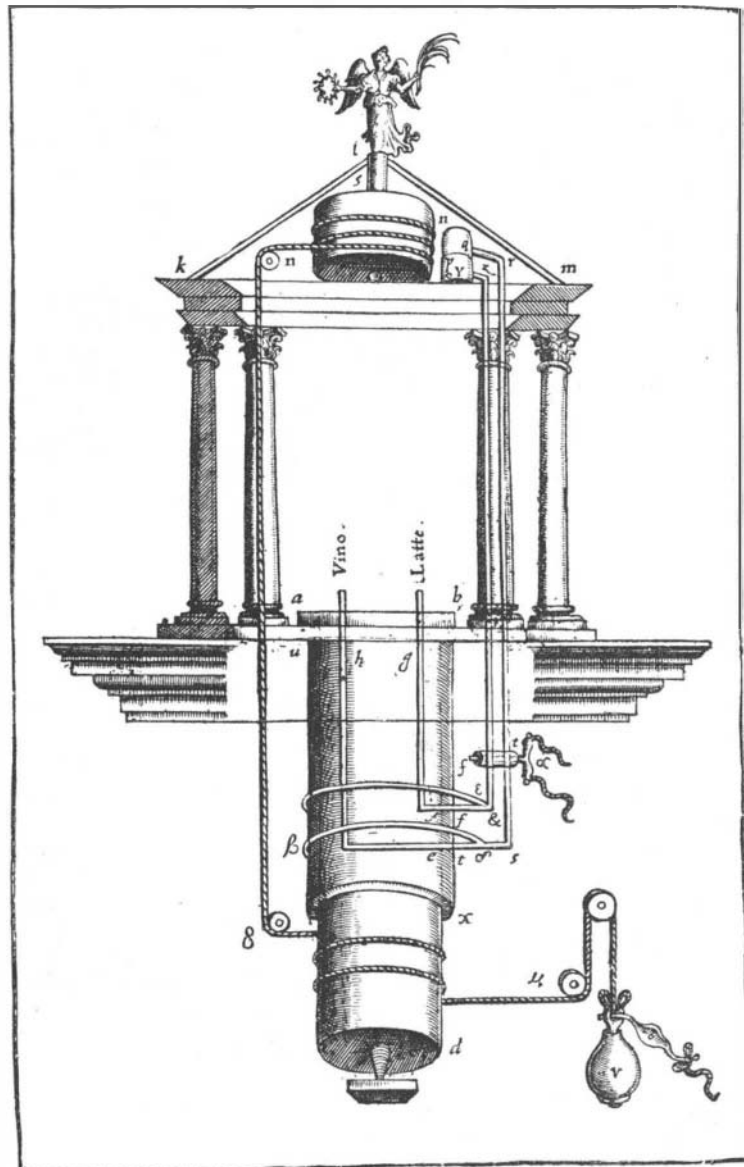
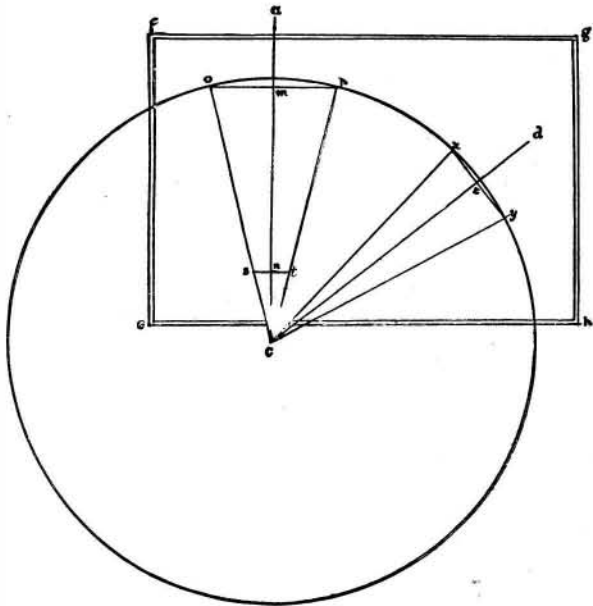


Fig. 6.—THE SHRINE OF BACCHUS—MECHANISM FOR DELIVERING WINE AND MILK.

screws by which the bearings of either set of wheels could be raised or lowered, so as to cause the shrine to move in the way proposed.

Fig. 6 shows machinery adapted to the shrine by which, on turning the figure of Victory at its top, two fountains beneath its canopy could be made to discharge wine or milk at pleasure. This apparatus is an adaptation of the two-way cock, whose plug, seen at

Fig. 5.



d, is turned by the enwrapping cord as shown. The milk was contained in the vessel, y, and the wine in q, and the two liquids pass down through one of the columns of the canopy, by the tubes, z r, and when the plug, d, is turned half around as described, the fountain jet that was discharging milk then flowed with wine, and milk took the place of wine in the other jet. The fountains were stopped by turning the duplex cock, f, and thus cutting off the supply of both liquids.

The mechanism of this shrine of Bacchus proves that 2,000 years ago the fact that wheeled vehicles could be propelled by power applied to the axles on which the driving wheels were fastened was well known, and that the mechanical principles involved in the application of the power were well understood. Furthermore, the shrine affords evidence of a high degree of refinement in mechanical manipulation in the cylindrical plug two-way cock, as well as in the general arrangement of the details of apparatus for performing the seeming miracle of changing wine into milk or milk into wine.

It is confidently believed that this is the first time this self-moving vehicle (which the shrine certainly was) of Hero has been described or even referred to by any writer in the English language. This is not strange, for the work of Hero descriptive of automata is very scarce, and the translations of Commandine into Latin and of Baldi into Italian are also rare.

It is universally admitted by writers on mechanics that Hero is the author of the first description of a machine actuated by steam; but hitherto no one has claimed for him the honor—to which the evidence above submitted clearly entitles him—of having invented the first self-moving carriage or locomotive.

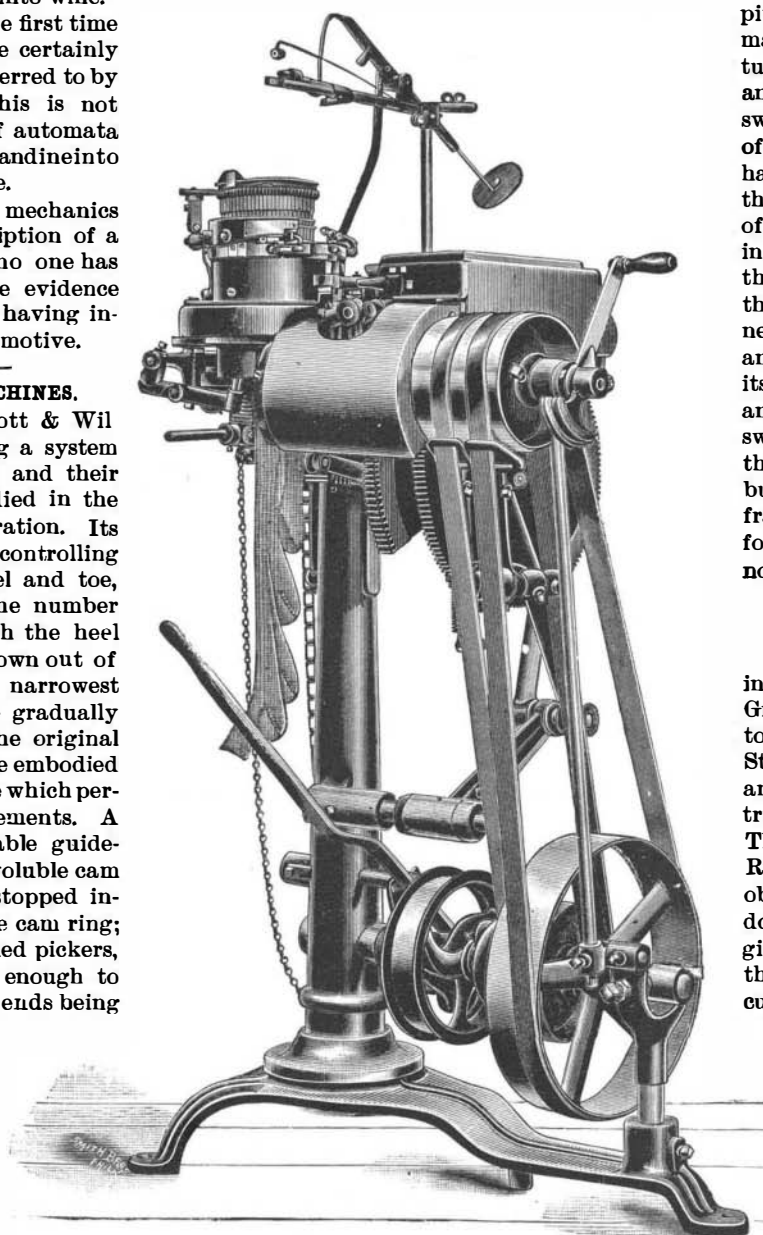
SOME NEW AMERICAN KNITTING MACHINES.

For some five or six years past Messrs. Scott & Williams, of Philadelphia, have been perfecting a system of automatic seamless hosiery machinery, and their latest improvements in this line are embodied in the machine shown in the accompanying illustration. Its chief characteristic is the mechanism for controlling the needles during the knitting of the heel and toe, involving first the gradual diminution of the number of needles of the group or series upon which the heel or toe is to be formed, one needle being thrown out of action, then another, and so on until the narrowest portion is reached, whereupon needles are gradually returned to action, in like manner, until the original number are once more in action. The device embodied in the machine is constructed on a principle which permits the needles alone to control its movements. A frictionally mounted ring is carried in suitable guide-ways at or near the upper edge of the revoluble cam ring, and this ring is free to turn or to be stopped independent of the movement imparted to the cam ring; upon this ring are mounted two levers termed pickers, the inner ends of which extend inward far enough to engage the butts of the needles, their outer ends being under the control of a pivoted lever carrying segmental plates. One of these pickers is poised at or near the middle of its length and has its inner end recessed or stepped; the other slides bodily in suitable guide-ways. Assuming that one-half or thereabout of the whole number of needles in the head are thrown out of action, the direct moving picker is brought into contact with the butt of the first needle of the inactive set and

stopped or arrested thereby, and while so arrested an upward thrust is imparted to it by the lifting lever, whereby it is not only itself raised, but, owing to the presence of the recess or step in its inner end, the needle is raised with it, and thus thrown out of action; another reciprocation of the machine carries this picker to the other side, where the same action takes place, and the first needle of that side is thrown out of action. This operation is continued until all necessary needles have been thrown out of action, whereupon the segmental plates carried by the lifting lever are moved, so that they engage with the poised picker, the under end of which travels in a path immediately above the butts of the inactive group of needles. The friction ring is still stopped by the first mentioned picker contacting with a needle butt, and the poised picker is brought into a position immediately over the butt of the first needle of the active set, and as its outer end is lifted by the lifting lever its inner end is depressed, which carries a needle with it. This takes place in like manner on the other side, and is continued until the heel or toe is completed. The needles are not subjected to the slightest side strain when being acted upon by the pickers, and the thrust is delivered in a direct line with the length of the needle. No changes of mechanism whatever are necessary in order to effect a change of gauge, and no derangement of parts can interfere with the correct and accurate operation of the needle-controlling members. At the beginning of the heel or toe the necessary needles are thrown out of action en masse by mechanism partaking of the nature of that above described for acting upon individual needles, in so far as the thrust is imparted in a line with the length of the needle, the mechanism for this purpose being of a most simple, ingenious, and substantial character. In order to insure the lowest possible percentage of "menders," circular courses are introduced between the joints of both heel and toe, the mechanism allowing the number of courses forming these gores to be increased or diminished at will. Either ladies' hose, men's half hose, or children's ribbed hose, or any combination of these types, are made with equal facility on the machine.

The machines of this firm are now in use among some of the leading concerns in this country, and in England and on the Continent of Europe, Messrs. Geo. Blackburn & Sons, of Nottingham, England, having been selected as builders for its distribution abroad, and the home plant being at the corner of Sixth and Arch Streets, Philadelphia.

In a recent speech on the tariff bill Senator Quay said: "It is not an exaggeration to assert that the best

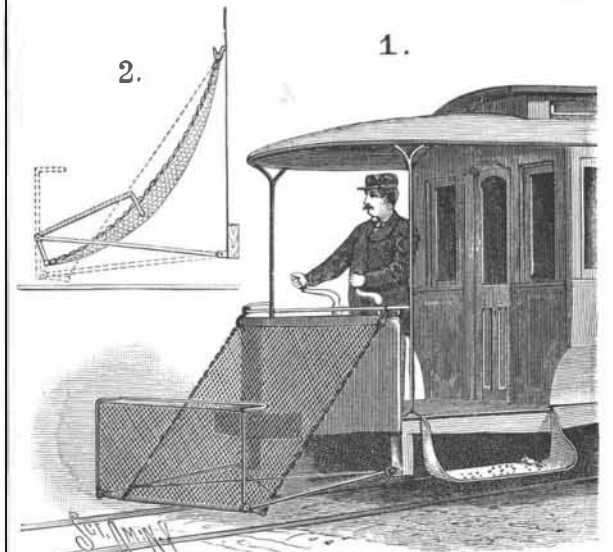


SCOTT & WILLIAMS' IMPROVED AUTOMATIC SEAMLESS HOSEIERY MACHINE.

knitting machinery in the whole world, for the manufacture of articles of wearing apparel consumed by the masses, is of American origin. So excellent is much of this machinery, and it is sold at a price so low, that there is a large and growing European demand for it. At this moment multitudes of American knitting machines, making hosiery of the lower grades, are being operated upon the Continent of Europe, and some of the best kinds of American machinery are built and sold in Europe by machine builders under agreement with American patentees."

AN IMPROVED STREET RAILWAY CAR FENDER.

The fender shown in the illustration is designed to be so flexible that it cannot possibly injure a person



EATON'S CAR FENDER.

whom it strikes, but will catch up such person in such way that he or she will be carried safely along with the car until the latter may be stopped. The improvement has been patented by Mr. Henry W. Eaton, of No. 45 William Street, New York City. Fig. 1 shows the device in use, Fig. 2 being a side view, representing the position of the parts when a person has been caught on the fender. A forwardly extending lower framework is connected by a hinge joint to the car, and chains extend from the forward end of the frame to hooks at either side of the dashboard. The chains are connected by a netting, and are only indirectly connected with the lower frame, being attached at their outer ends to the arms of a swinging frame pivoted to the lower frame, and which extends normally upward, as shown in Fig. 1, this frame when turned over, as shown in Fig. 2, striking the chains and network to depress them near the center, and swing them and the frame up slightly at the front end of the fender. The lower arms of the swinging frame have at their free ends a cross bar extending beneath the sides of the lower frame, limiting the upward swing of the arms and the outward movement of the swinging frame. The first effect of striking a person is to cause the upright frame to yield gradually, so as to break the force of the blow, and at the same moment the network, engaging the legs tightly between the knees and the ankles, relieves the body of much, if not all, of its weight and prevents the danger of breakage of the ankles by sudden shock. The vertical frame then swings inward under the weight of the falling body thus thrown upon the two nettings, the side chains buckling and raising the lower portion of the fender frame at its outer end. The whole device may be folded up in small space on the end of the car when not in use.

The Alaska Boundary.

A part of the expedition which has been engaged in surveying the boundary between the property of Great Britain and Alaska has returned to Washington. The joint survey of the boundary by the United States and Great Britain is now practically complete, and the State Departments of the respective countries may begin work at once on the conflicting claims. The greater portion of the region purchased from Russia is definitely located on the 141st meridian. The object of the English is said to be to force the line down to cross some of the broad inlets which would give them water access to their own territory, so that they would be entirely independent of United States custom regulations.

One of the interesting facts established by the expedition was that Mount St. Elias is not on United States territory, and that it must give precedence in regard to height to three mountains further inland, which all stand in British possessions. The height of Mount St. Elias as determined by this year's party is 18,023 feet, while Mount Logan is 19,534 feet high. The other two peaks are nameless as yet. There were no lives lost in the expedition and the trip was regarded as being very satisfactory.