

contemplated this Appearance for above an Hour, *viz.* from 10th to near twelve, and we could not be deceiv'd as to its Reality; but the Slowness of its Motion made us at that time conclude that it had none, and that it was rather a *Nebula* than a *Comet*.

However, suspecting that it might have some Motion, I attended the next Night, *June 11th*, at the same Hours and in the same Company, when with some Difficulty by reason of the Thickness of the Air, we found the two little Stars, but the *Nebula* could not at that time be seen, which we then imputed to the want of a clearer Sky. But on *Saturday, June 15.* the Moon being absent, and the Air perfectly clear, we had again a distinct View of the two Stars, with an entire Evidence that there remained no Footstep or Sign of it, in the place where we had first seen this *Phenomenon*, which we therefore now found to be a *Comet*. and that being far without the Orb of the Earth, and in it self a very small Body, it appeared only like a little Speck of a Cloud, such as would scarce have been discerned in an ordinary Telescope, much less by the naked Eye.

IX. *An Account of Books*, I. Joannis Poleni in Gymnasio Patavino Phil. Ord. Prof. & Scient. Societatum Regalium, quæ Londini & Bero-
lini sunt, Sodalis, *De Motu Aquæ mixto*, Libri duo, &c. 4^{to}. Patavii 1717.

THE Subject here treated of not having hitherto fallen under the Consideration of Mathematical Writers, the Learned Author is obliged to make use of several Terms, which are either wholly new, or at least

least are apply'd in a sense somewhat different from their common Acceptation; for which reason he begins his Work with a Set of Definitions.

Aqua mortua, or a dead Water is that whose Surface being every where equally distant from the *Centrum gravium*, no part of it can descend any lower, without forcing some other upward, and consequently the Whole is without Motion.

Aqua viva, or a running Water is that which is put into motion by the Pressure of the incumbent Water, and whose Motion is opposed by no other Water lying in its way.

The motion of a running Water is call'd *Motus simplex*, or the simple Motion.

If a running Water moving over the Surface of a dead Water, do, by its Pressure communicate part of its Motion to the dead Water; the compound Motion with which the whole Body of the Water flows, is called *Motus mixtus*, or the mixt Motion.

If a Water at different Depths from the Surface run with different Velocities, the *mean Velocity* is that, which being the same at all Depths, will discharge the same Quantity of Water.

Next follows a short History of the Original, and Progress of the Doctrine of running Waters, the Invention of which our Author justly asserts to the Learned *Castellus*, and defends him against *Fabretti*, who has maintain'd that *Castellus's* fundamental Proposition of the Quantity discharged being *ceteris paribus* in proportion to the Velocity, was known, and publickly taken notice of before him by *Frontinus*.

The Author allows *Castellus* to have been mistaken in determining the Velocity of Water running out at the bottom of a Vessel, he having asserted that Velocity to be as the Depth of the Water

Three Years after *Castellus's* Book came out, this Mistake was corrected by the famous *Toricellius*, who was the first that maintain'd, that the Velocity of the Water running out was in a subduplicate *Ratio* of the Depth; but gave no Demonstration of it.

This Proposition, says our Author, was confirm'd by the Experiments of *Maggiotti*, *Mariotte*, and *Guglielmini*, and has since been demonstrated by Mr. *Varignon*, by *Herman* in his *Phoronomia*, and *John Bernoulli*. as reported by *Herman* in the *Acta Lipsensia*.

Here it may not be improper to take notice, that the Demonstrations of those three Learned Persons are all grounded upon this Supposition, that the Water running out from the Hole is prest upon by the Column of Water incumbent upon it, which may easily be demonstrated to be a Mistake. Likewise, if their Demonstrations be just, it will follow, that the first Drops of Water, which issue out from the Hole, must run with the same Velocity, as after the Water has been running some time; the Contrary of which appears to be true in Fact by the Experiments of the famous Mr. *Mariotte*.

The Author might have found a juster Account of this matter in the Writings of a Great Man, whom he cites on another Occasion; the second Edition of whose Book was come out some time before *Herman* publish'd either of those Demonstrations, and had been seen by him, as appears by his quoting it frequently, and mentioning the Difference in this very Particular between the first and second Edition.

Our Author goes on to consider the simple Motion of Water running out by a Section perpendicular to the Horizon, in the side of a Receptacle, which is always entertain'd at the same Height. He shews, that the Velocities, with which the Water issues out at different
Depths,

Depths, being as the Roots of those respective Depths, may be represented by the Ordinates of a *Parabola*, whose Axis represents the entire Depth of the Water. Consequently, since the Quantities of Water, running out at different Depths, are as those Velocities, they likewise may be represented by the same Ordinates, and the Quantity of Water discharg'd from the whole Section, will be represented by the Parabolick Space; and the mean Velocity by that same Space divided by the *Abscisse*.

The Times, being as the Quantities of Water discharged, may be represented in the same manner as those Quantities.

Hence he derives his general Theorem, That the Quantities of Water discharged, are in a *ratio* compounded of the sesquiplicate *ratio* of the Depths of the Water, the *ratio* of the Breadths of the Section, and of that of the times of the Efflux.

The Author proceeds now to the mixt Motion of Water; in order to discover the Nature of which he has made some curious Experiments, after the following manner:

A large cylindrical Vessel, with a perpendicular Section through the side of it, was placed upright in a dead Water; so that the bottom of the Vessel was a considerable Depth below the Surface of the Water; and the Vessel was kept immovable in this situation.

Above this was fixt another Vessel, full of Water, whose Bottom was pierced with 16 Holes, exactly round, and of the same Bore, and so order'd, as to be open'd, or stop't at pleasure. The Water in this Vessel was always kept at the same Height, by means of a third Vessel, which supply'd the Water, as fast as it ran out at the round Holes in the Bottom; and a large Aperture, in the side of the second Vessel near the Top, prevented

prevented the Water in it from exceeding the due Height. To break the Force of the Water running into the two lowermost Vessels, they were each of them divided by a Board, placed perpendicular, but not reaching the Bottom, which separated the Part where the Water came in, from that where it went out.

The *Apparatus* being thus fixt, three of the round Holes in the Bottom of the second Vessel were unstopt, to let the Water run into the lower Vessel. Where not running out at the Section in the side, so fast as it came in from above, it rose to a considerable Height above the Surface of the dead Water; after which, the Efflux of the Water becoming equal to the Influx, it rose no higher.

In other Tryals the Water being suffer'd to run from 6, from 9, 12, and 15 of the round Holes, the Water rose successively to greater Heights, before the Section discharged it as fast, as it came in.

The Experiment being repeated with opening other Numbers of the round Holes, with Sections of different Breadths, and at different Depths of the dead Water, the several Heights, to which the Water rose in the Vessel, were carefully observ'd and set down.

Other Experiments were made by placing the lower Vessel on dry Ground, and the several Heights to which the Water rose in the Vessel, according as different Quantities were suffer'd to run in, were likewise observ'd, and found agreeable to the Heights deduced by Calculation from the general Theorem above-mention'd, concerning the simple Motion of Water.

The Learned Author comes now to apply these Experiments, in order to discover the Theory of mixt motion, to which end he lays down these two Hypotheses.

First, he supposes, that the Velocity of the running Water is every where in a subduplicate *ratio* of the Depth, and consequently the Quantities discharged may be represented by the Parabolick Spaces, just as in the case of the simple Motion of Water.

Secondly, that the Velocity of the dead Water, is the same at all Depths, and equal to the greatest Velocity of the running Water. Wherefore the Quantity of dead Water discharged may be represented by a Rectangle, whose Height represents the Depth of the stagnant Water, and whose Base is the greatest Ordinate of the Parabolick Space abovementioned.

Having thus contrived a way of representing the Quantities of Water discharged by the mixt Motion, as had been done before for the simple Motion of Water, our Author observes that the Velocities of the Water issuing out at different Depths, and consequently the Parabolick Spaces representing the Quantities of Water expended, must be less in the mixt, than in the simple Motion.

In order therefore to find a general Rule for determining the Proportion between the Parabolick Spaces, which represent the Quantities discharged by the mixt and simple Motion, or between the Parameters of those *Parabolas*, he draws some Observations from the foregoing Experiments, by the help of which he hopes such a Rule may be found out.

First, he observes. that, if the Depth of the running Water continue unchanged, a greater Depth of dead Water requires a less Parameter.

Secondly, That this Parameter does not decrease in so great a Proportion, as the Depth of the Water increases

Thirdly, That, if the Depth of the dead Water decrease, or the Depth of the running Water increase in
such

such manner, that the latter becomes infinitely great in proportion to the former, then the Parameter of the mixt Motion must become equal to that of the simple Motion.

Fourthly, That, if the Depth of the dead Water become infinitely great in comparison of the Depth of the running Water, the Parameter of the mixt Motion vanishes, or becomes equal to nothing.

The Rule, therefore, which is to be found, ought to agree with all these Observations, and besides must produce the same Quantities of Water by Calculation, as were found by Experiment to answer to the several Depths of running and dead Water, in the above mention'd Tryals.

Upon this Foundation the Learned Author proceeds, in a tentative Method, to find his Rule, and having discover'd it, he shews by Calculation, that it answers all the Conditions before requir'd.

This Rule is express'd in a pretty high Equation, which, besides other Operations, requires the extracting the Root of the sixth Power.

From this Equation is derived another, serving to find either the Quantity of Water discharg'd, the Depth of the running, or that of the dead Water, the other two of them being given; as likewise a third Equation, to find the mean Velocity.

Our Author goes on to shew the Usefulness and Necessity of considering the Doctrine of mixt Motion, in all Questions relating to the Course of Rivers, the Quantities of Water which they discharge, the enlarging or narrowing their Outlets, the scouring and deepening their Channels, and the Motion of the Tides in Harbours. These he illustrates by several Deductions from the Equations above mention'd; to render which of greater Evidence, it were to be wisht, that those Equations

were built upon a more solid Foundation than a tentative *Calculus*; and that Allowance had been made for the Velocity impress'd upon the preceding Water in Rivers, by the *impetus* of that which follows, which is omitted by the Author in his Theory, both of mixt and simple Motion.

In the Second Book, this Learned Writer proposes the State of the *Laguna* of *Venice*, as a proper Example, to demonstrate the Usefulness of his new Theory. He considers very minutely the several Causes of choaking up the *Laguna*, examines the Methods proposed by various Authors for scouring and keeping it clear, some of which he rejects as impracticable on account of the Expence, others as useless, or prejudicial; and lastly delivers his own Opinion.

The principal Causes, which he assigns, of filling up the *Laguna*, are the Rivers running into it, and the Sea.

The Rivers, which enter it, arising out of the *Alps*, and running down with great Rapidity, carry with them, especially after Rains, great Quantities of Soil, which is easily suspended in the Water, so long as that Swiftnes of Motion continues. But when they come into the *Laguna*, the Water, upon extending it self over that vast Surface, looses almost all its Velocity, and consequently the Soil and Filth, which before it carry'd with it, subsides in great Quantities to the Bottom.

The Remedy our Author proposes for this Inconvenience, is either wholly to divert the Course of the Rivers, and carry them, by another Way, directly into the Sea; or at least, to secure their Outlets with Sluices, so as to suffer them to pass into the *Laguna*, when their Waters are clear; but after great Rains, when they run foul and turbid, to stop their Passage that way, and let them out by the other Channel into the Sea.

The

The second principal Cause of choaking up the *Laguna*, is the Sea. Concerning which our Author observes, that the Tide of Flood sets into the *Laguna* from along the Coast of *Istria* and *Friuli*, where it is perpetually washing away the Land in great Quantities, with which, and the Sand which it raises upon high Winds in the Shallows near the Shore, it enters the *Laguna* exceedingly turbid and foul; especially, when the Wind blows hard at South-East, at which times the Tide of Flood is several Hours longer than the Ebb. This occasions very high Tides in the *Laguna*, and a great part of the Water, which enters by the Flood, not being carry'd out by the subsequent Ebb, has the more time to discharge its Soil and Sand in the *Laguna*.

This is an Enemy very hard to deal with, however our Author proposes some Works of strong Piles, and large Stones thrown in between them, to be carried directly forward into the Sea, in order to break the Violence of the Waves, and prevent their washing and carrying away the Land.

He seems likewise to favour a Proposal made by the late famous *Guglielmini*, and some others, to let the Tide enter the *Laguna* by more Passages than it is to go out at, in order to make it run out with a greater Velocity, and thereby scour and deepen the Channels. But he thinks this Contrivance will scarcely perform all that is expected from it; besides that, it will be attended with great Difficulties in making Works, and Flood-gates of a sufficient Strength, to resist the Violence of the Waters.

He occasionally combats the Opinion of *Guglielmini*, and most other Mathematicians who have thought upon the Subject, that in order to give a greater Velocity to the Water of a River, thereby to scour and cleanse the Channel, it is proper to make the Outlet narrower.

narrower. This our Author maintains to be oftner false, than true, and endeavours to shew from his Theorem above-mention'd, that making the Outlet narrower, will frequently cause the *mean Velocity* of the Waters to become less than it was before. But whether a Proposition of such Consequence, and seemingly so well supported by Reason and Experience, ought to be condemn'd upon the Authority of a Theorem founded only upon a tentative Calculation, must be left to the Judgment of the Learned.

II. Apollonii Pergæi *Conicorum Libri Octo*, & Sereni Antiffensis *de Sectione Cylindri & Coni Libri duo*. Fol. Reg. E Theatro Oxon. 1710.

THE worthy Curators of the Oxford Press having obliged the Publick with a very elegant Edition of the Works of *Euclid*, Græco-Latinè, were pleas'd further to proceed in the laudable Intention of giving the rest of the ancient *Greek Mathematicians* in the same beautiful Form: In this Design they were chiefly animated by the late learned and beneficent *Dean of Christ Church*, Dr. *Henry Aldridge*, who pitching upon *Apollonius*, as most proper to succeed *Euclid*, engaged the two *Savilian Professors* to take upon them the Care and Pains of the Edition: Dr. *David Gregory* promising his Assistance as to the first Four Books, which are still extant in *Greek*; and Dr. *Edm. Halley* undertaking to translate the Fifth, Sixth, and Seventh Books out of *Arabick* (in which Language they were only to be found) and to endeavour to restore the Eighth, long since wholly lost. But Dr. *Gregory* soon after dying, the Care of the Whole devolved on Dr. *Halley*, who hath spared no Pains to render the Work complete.

He in his Preface tells us what Helps he had to perfect the Text, That he had the use of two *Greek MSS.* of the first Four Books, one of which was Sir *Henry Savil's*, and is in the *Savilian Study* at *Oxford*, the other is now in the
Royal

Royal Society's *Museum*, having been lately presented them by that skilful Mathematician Mr. *William Jones*, F. R. S. That he had only one Manuscript of *Eutocius's* Commentary, out of the *Bodley Library*; and two *Greek Copies*, from the *Savilian Study*, of *Pappus's* Collections, out of whose 7th Book he took the *Lemmata*, which serve as a Comment on the more difficult Places of his Author; and that he was forced to revise and correct the Mistakes and Improprieties of the Latin Translation of *Commandine*.

As to the latter Books, which were only in *Arabick*, he informs us, that he made use of the *Bodley Transcript* of a *Manuscript* that is at *Leyden*, which it self is a late Copy of that ancient *Arabick Book* of the *Conicks*, heretofore *Golius's*, but since purchased by that great Patron of Universal Learning, *Narcissus* late Primate of *Ireland*, who was pleased to favour him so far as to send over into *England* this Original Book whereby he not only amended several Faults committed by the Copyists in a double Transcription, but was also assured that this *Arabick Book* was a verbal Translation from the *Greek*; the same Schemes markt with the same Letters, and the whole Context being the same in the first four Books of it, as in the *Greek Apollonius*. This valuable Manuscript, with about 800 others, *Oriental* and *Greek*, has since, by the Donation of that most venerable Prelate, made a noble Accession to the *Bodley Library*, wherein it is now deposited. It appears by an *Epigraph* at the end, to have been written in the Year of *Christ 1303*. and to have been a Copy of a Translation of the *Conicks*, made some Ages before by *Thebit Ben Corab*, but then newly revised by that famous *Persian Mathematician Nasir-eddin*, who flourish'd about the middle of our thirteenth Century.

Besides this, the Editor tells us, that on occasion he consulted another *Arabick Manuscript* (heretofore *Ravius's*) of great Antiquity, being an *Epitome* of the same Books by *Abdolmelec* of *Schiraz*, every where agreeing in the Order and Argument with the former, but abridg'd. So that having had these Helps, he is in hopes that he has so far retrieved those Three Books of *Apollonius*, that the Loss of the *Greek Text* may henceforth be less lamented.

The

The Eighth Book of these Conicks, was wanting in the Greek Copies even before the Traduction of them into *Arabic* by *Thebit*: But it having been observ'd that there was a very near relation between the Arguments of the VIIth and VIIIth Books, for that the same *Lemmata* of *Pappus* were common to them both, which are different to all the rest, it seem'd that the *Theoremata Diuistica* of the VIIth Book were designed to determine the Limits of the *Problemata Diuistica* of the VIIIth; and therefore supposing what those Problems might have been, and their Order from that of the said Theorems, Dr. *Halley* has in XXXIII Propositions given the *Analyses* and *Syntheses* of them, after the Method of the Ancients, every where following the Steps of *Apollonius* to be found in his VIIIth Book. This he calls *Conicorum Liber Octavus restitutus*, and may serve the turn, till such time as the Original Eighth Book come to light; if that be not now to be despair'd of.

Because of the Affinity of the Subject, he hath subjoin'd the two Books of *Serenus Antissensis*, the Greek Text of which was never before in print. This was procured by the abovesaid Reverend Dean of *Christchurch*, Dr. *Aldrich*, in a collated Copy of three Manuscripts extant in the King's Library at *Paris*, and by him, according to his wonted Goodness and Generosity, freely communicated for the use of the Publick. To this also is added the Latin Translation of *Commandine*, which in many Cases needed Castigation.

As to the Authors themselves little needs be said, they having stood the Test of so many Ages, and been highly valued by the Learned in all Times, especially the Conicks, justly esteem'd a Masterpiece in the Geometry of the Ancients: So that it may seem strange, that a Book so excellent in its kind should not till now have been printed in its native *Greek*, a Tongue so peculiarly adapted to Mathematical Purposes. But this present Edition may make ample Amends, the Paper and the Elegance and Correctness of the Print being remarkable. The Book is now to be had of Mr. *Christopher Bateman* in *Pater-noster Row*, *London*.