

his honest grief? Why should he not have tears wrung from his very heart—only a tailor's heart—provided that Messrs. Glanvil and other such honourable men can wear his cloth and take the labour of his hands, "to keep up appearances!"

"I am sorry," Doctor Ferrol said truthfully—"I am very sorry to hear this."

Little did Mr. Bodkin guess how nearly alike was their position, and what writhings of conscience his recital had called up. Hugh went to his desk as soon as he got home, and taking one of its very few bank-notes, inclosed it to the clothier in part payment of his account, and astonished the majestic Marks by commanding him to deliver the letter at once, duly waiting for an answer.

Agatha was as usual in the nursery, where Baby lay awake in her cot, one tiny pink hand clasped round her mother's finger; which feat was hailed by mama and nurse as a prodigy. But papa's dark face frightened his little daughter; she turned away her head and cried, which pleased him not. The mother's sympathies tried to harmonize both parties, and scarcely succeeded. A mere trifle would now seriously discompose the once light-hearted Hugh.

But she had never seen him so discomposed; she had not thought he could be so ill-tempered, as when, later in the evening, she ventured to ask him for money—wages owing to the nurse—he accused her of systematically tormenting him—of caring more for that wretched infant than ever she had cared for him. What other querulous things he said in the unreasonableness of his anger shall not be recorded. His wife was resentful for a moment at his injustice, but soon the tears of wounded affection began to flow. He would not look at her, or he must have hated himself for his violent words. Agatha went away to that solace of many a heart-stricken wife, the child's cradle, and, as she passed up the stairs, heard the hall-door slam loudly after her husband. The first unkind parting! what a sad epoch to a loving heart!

While he was absent, the latest postal delivery brought two letters addressed to him; one Agatha knew to be in Richard Wardour's writing—the other unknown. Both were lying on his study table when he returned—indicated by Marks with the words, "Letters, Sir."

He had generally some apprehension of what the post might bring, and eyed the unknown letter suspiciously as he drew off his boots. Wardour's was of little consequence; still he dallied over the few lines, for it retarded the opening of the other blue envelope, which he was certain contained unpleasing news. Has not a letter a physiognomy? This was ill-favoured—baleful.

At last he opened it deliberately with a penknife, trying to leave the wafer uninjured—as if that were of any consequence. To the foot of the page was the signature of the house-agent; and the one paragraph, which his eyes gathered the meaning of rather than read, demanded an arrear of rent long due, and threatened a distraint upon the premises.

He flung down the sheet angrily, with a suppressed exclamation of rage and dismay. For some minutes he could not think clearly; a mist thick-

ened before his eyes—his brain was dizzy. An execution in his house! what could be more dreadful? His prospects in life would be ruined; all the other creditors would swoop down upon his fallen fortunes; what would become of him? And his poor wife! He sat moodily gazing into the fire for a long time; the lines on his face deepening and hardening, a frown fixing upon his brows, desolation in his heart.

Not two years started on the arena of life, and already run to the wall—already his ambitious dreams evaporated, his high hopes dashed with the direst discomfiture? Oh, saddest termination of youth's strivings! To this miserable exposure had come the falsity and pretension of his life. He ran over his friends mentally, and could perceive no help. Sir Lancett Pyke was the closest miser breathing. Euston Ferrol had once aided and once warned him, and he knew would do so no more. His father-in-law could hardly meet his own liabilities. Richard Wardour was too poor; besides, there would not be time to write to him, and it was totally unlikely that he had a hundred pounds to spare.

Still Hugh, with a lingering hope, turned to the table and took up his short friendly note. There would at least be no unwillingness, if he had the power to serve him, which was doubtful. But the sinking man clutched at even this straw. He wrote a hurried letter imploring the loan of fifty pounds, and faithfully promising repayment within a given period. Hugh had become very facile at such promises. He would go to the nearest receiver himself and post the letter, that it might be on its way that night. And yet, three days must elapse before an answer could arrive. He hesitated. His eyes fell upon Mr. Wardour's signature; and at that instant a dark thought entered his heart. Mr. Wardour was engaged in a law-suit, which rendered the raising of ready money at times indispensable. How plausible was the scheme! "And then," further whispered the temptation, "he need never know of it. The bill can be taken up before it falls due; nobody will be injured, and you will be saved."

He did not resolutely put away the proffered crime, but permitted it to be acted over in his thoughts. He felt in a fever. What! commit forgery! This ugly name decided him for some half hour; but with contemplation of the iron difficulty returned also the evil way of escape, and the soothing persuasion that perfect secrecy might be insured, and no harm done. Here was the bait!

LEAP YEAR.

THE speedy steps and strong arm of Time have once more brought round our quadrennial epoch of Leap Year. So regular a visitor can neither be unexpected nor unwelcome; for an interval of four years is not much to look forward to, and an addition of a whole day to our scanty thread of life is acceptable to all; so that, altogether, this little break in the routine of an ever augmenting sum of years is regarded with interest, and a few words

about so old a friend are certainly reasonable in 1860.

It was a sage remark of Lord Bacon, that men have always ascribed more regularity to the laws of Nature than she herself has assigned to them; and this is well exemplified in the case of our planet's diurnal and annual motions. No doubt, to the ancient astronomers it appeared only reasonable that these should have some close and clear correspondence, and thus days should prove a safe and simple gauge for years. But facts were always stubborn; and, in spite of the complacent admeasurements of Latin priests and augurs, days, months, and years were plainly at sixes and sevens amongst themselves, when the imperial will and sagacity of Julius Cæsar decreed an alteration, and removed the chief source of their complications, by the bold and simple device of a Leap Year.

To shorten a long story, we may remind our readers that this renowned warrior and statesman, having ascertained from an Alexandrine astronomer that the year was 365 days and six hours long (as they supposed), determined to adopt the correction. The months were apportioned out as they are now, and the civil year framed to correspond with the solar, by lengthening out the number of days in February to twenty-nine, every fourth year: thus compensating, at the end of that interval, for the four *quarter days* which otherwise would have been irretrievably lost. In this, the Julian calendar, the name given to the fourth year was "Bissextilis," because the extra day was inserted on the day following the sixth before the Kalends of March, and was thus called the *double sixth*, or, in the legal diction of Rome, "Bissexto die ante Kalend. Martii." So that, in ordinary years, the 24th February (reckoning backwards from 1st March) would be the fifth day before the Kalends, but in Bissextile years it would be the sixth—the double sixth, or "bissexto die," being then the 23rd of February.*

How we have fallen upon the name Leap Year is not so evident, for it is manifestly a leap backward that is taken, not one in advance; since, were it not for the ingenious contrivance of Cæsar, we should at every fourth annual revolution have the civil year a day in advance of the solar.

It is not difficult, however, to see that though this arrangement of an intercalous day served well enough for keeping the chronological periods in harmony for a considerable time, yet it really made every year more than eleven minutes too long, namely, 365 days 6 hours, instead of 365 days 5 hours, 48' 50", being an excess of about one day in 135 years; and it was the accumulation of this error through successive centuries that was gradually throwing the relations of the civil and solar year once more into confusion.

At the famous Council of Nice, held at Nice in Bithynia, under the presidency of Constantine,

* The Romans called the 1st of every month the Kalends, from the priests *calling out* on that day the feasts and ceremonies to be observed throughout the month; and the few last days of the preceding month were reckoned backwards. Therefore, strictly speaking, it was not the 29th of February which was intercalated in Bissextile years, but the 23rd of February, or the *bissexto die*, as we have stated above.

A. D. 325, the error caused by this recurring series of eleven minutes must have amounted to more than two days; yet no rectification was introduced, if even its necessity were at all recognised. This council fixed Easter in that year for the 21st March, which was the day of the vernal equinox; but as the year was constantly made too long, the equinox went on receding, till eventually Easter day and Christmas day might have coincided! However, about A. D. 1580, the error had become inconveniently great, amounting to ten days, the sun entering Aries on the 11th March instead of 21st. Yet, astronomers and philosophers might have been puzzled to find—not a remedy—but one able to apply it, had not Rome, no longer imperial, yet with more than a Cæsar's power, resolved to settle the difficulty in a very summary way. Pope Gregory XIII issued a bull in 1582, and decreed that, through Latin Christendom at least, the 5th October in that year should be called the 15th. Truly a wonderful step for conservative Rome, who but a few years later could make a Galileo recant his propositions of the earth's motion in space, and even in later times has certainly not improved in astronomical attainments, if, at least, we are to give heed to the famous attempts of an Irish divine, to contend for the immobility—not only of Rome, amidst the conflicts of the world—but of the earth itself, amidst all her circling spheres! England, however, under Elizabeth, declined to receive instruction in science from the mouth of the pope, and so, as a reward for her contumaciousness, she had at last to cut off *eleven* days instead of ten: the error having increased to that amount in 1752, when it was enacted that the 3rd September in that year should be called the 14th. This alteration was by no means acceptable to the popular feeling, which resented so incomprehensible a robbery of its time; and more than one clamorous outcry was raised of "Give us back our eleven days!"

But with all these amendments, the calendar would not have been complete without some provisions against the recurrence of the old error; and it was therefore arranged by Gregory that three quarters of a day per century, or three days in every 400 years, should be cut off from the whole series, and thus the continued accumulation of error be neutralised. This is the peculiar feature of the Gregorian calendar, and it provides that only those centenary years whose index is divisible by four, are to be Leap years, while the Julian calendar of course made *every* hundredth year Bissextile! Thus, reckoning from A. D. 1600, the year 1700 and 1800 were secular or common years, and so will 1900 be; but the year 2000 will be a Leap Year. The error arising under this system is so small as to be entirely neglected.

It seems as if this subject of the calendars were always to be made an ecclesiastical question; for to this day the Russian and other Greek churches have adhered to the Julian system, known as O. S. or Old Style. At the present time they are twelve days behind us, and the error is continually on the increase. The inconvenience is very great; and we may reasonably hope that, amidst all the pending changes in the Muscovite dynasty, the

autocrat of all the Russias may adopt the Gregorian calendar, and thus harmonize the chronology of Europe on the not unimportant subject of Leap Year.

CHEMISTS AT WORK.

ANYBODY looking into the windows of a philosophical instrument maker's shop, or at the brass glittering array of shining apparatus figuring on a lecture-table, would be apt to form a very inadequate notion of the ways of chemical operators when they are at home and at work. Nevertheless, a certain cloudy idea seems to prevail, that the lecture-room type is not that which impresses itself upon the chemist in his every-day life and ordinary avocations. For example, I write a chemical book. I apply to my artist for a vignette. I interfere in no way with his taste. I allow his idealism full scope to sketch out such symbolical characteristics of the professor of hermetic art as shall best satisfy the artistic longings within him. He gives me an old bearded fellow, swathed in a sort of black dressing-gown, and seated most likely on a pile of books, assiduously blowing a primitive furnace with a pair of hand-bellows. Now, this type of individual might have been correct enough as the representative of an alchemist, but it is no more the similitude of the chemist now-a-days, than I am the similitude of Hermes Trismegistus. Chemists were formerly called "philosophers by fire," nor that unreasonably, for they were continually operating with furnaces. The tendency of modern invention has been to lessen the necessity for that sort of aid. Certain branches of chemical inquiry demand furnace heat still; nevertheless, as a rule, it may be said that furnaces have gone out amongst chemists, and ingenious lamps and gas-jets, when heat is required, have taken their place.

There cannot be a greater mistake than for a person just beginning the study of chemistry to lay out money in expensive apparatus. Forty shillings, judiciously invested, will be an ample outlay at first; and, as for the future, circumstances will regulate the further expenditure of money. Weighing and measuring underlie the whole of accurate chemistry; and weighing and measuring demand accurate—so far as weighing is concerned—and costly apparatus; but the beginner need not weigh at all, nor indeed measure otherwise than roughly. He wants to know the general aspect and qualities of chemical re-agents, to which end the operations of weighing and measuring would not aid him.

I have seen many chemists at work, and I never saw two work alike. I believe there is no less variety in this respect than variety of human features. Some are gigantesque in all they do, requiring gallons, whilst others would be satisfied with a drop. Some, having once got hold of a leading idea, fix on it like blood-hounds on their prey, follow it through all its tortuous windings, and hunt it down at last. Some chemists are great in laying hold of first principles, but slow to perceive the application of them. The Danish philosopher, Oersted, discovered, in 1819, the fact

that when an electric current was transmitted in parallelism with a magnetic needle freely suspended, the needle immediately laid itself across, or at right angles to the electric current. Oersted failed to see any practical application of this, though some twenty years later it became, under the practical guidance of Messrs. Cooke and Wheatstone, the foundation of the electric telegraph. There have been several varieties of the electric telegraph since then, but Cooke and Wheatstone's was the first; it is still very commonly employed, and it is the immediate offshoot from the discovery of Oersted. About the time when the late Sir Anthony Carlisle proved that by transmitting voltaic electricity through water in a particular manner, the water would be decomposed into two gases, oxygen and hydrogen, Sir H. Davy originated a theory to the effect that the two gases were held together in water because of their being endowed with two opposite electrical states; and it followed from this theory that except they should happen to be presented to each other under these two opposite electrical conditions, they would not combine. Very soon after Davy had enunciated this theory, two celebrated chemists, Wollaston and, I think, Children, might have been heard engaged in the following conversation:—

MR. CHILDREN.—"Suppose I take oxygen and hydrogen in the proportions necessary to form water, and compress them into the space which an equivalent amount of water would have occupied, will water be the result? and would it not be a good experiment?"

DR. WOLLASTON.—"The experiment would be hardly worth trying; the two gases would assuredly *not* combine."

MR. CHILDREN.—"Davy also says the experiment would be hardly worth trying—that the two gases would be sure *to* combine."

The joke is, that Wollaston, in offering his very decided opinion, was guided by Davy's own hypothesis, which Davy himself failed to see the application of.

The different temperament of chemists influences to a high degree the manner of their working. Some lock themselves up quite alone, and are impatient of any access to their laboratories. The great Dalton used to light his own laboratory fire early in the morning, rather than allow an assistant or servant to do it for him. In early life, motives of economy might have determined this course, but it was not always so. Wollaston and Cavendish were also solitary workers; and the former initiated the practice of what may be called microscopic chemistry. Wollaston is said to have often boasted that he could have put his whole stock of apparatus on a tea-tray. His way of getting at results by microscopic means was highly ingenious, and sometimes amusing. If a voltaic current of sufficient power be transmitted through a platinum conductor, the latter becomes glowing hot; and if the electricity be powerful enough, in the end it fairly melts. The experiment is a very common one now-a-days, but in the earlier period of voltaic electricity it was otherwise. Well, the same Mr. Children of whom I have already spoken, being desirous of