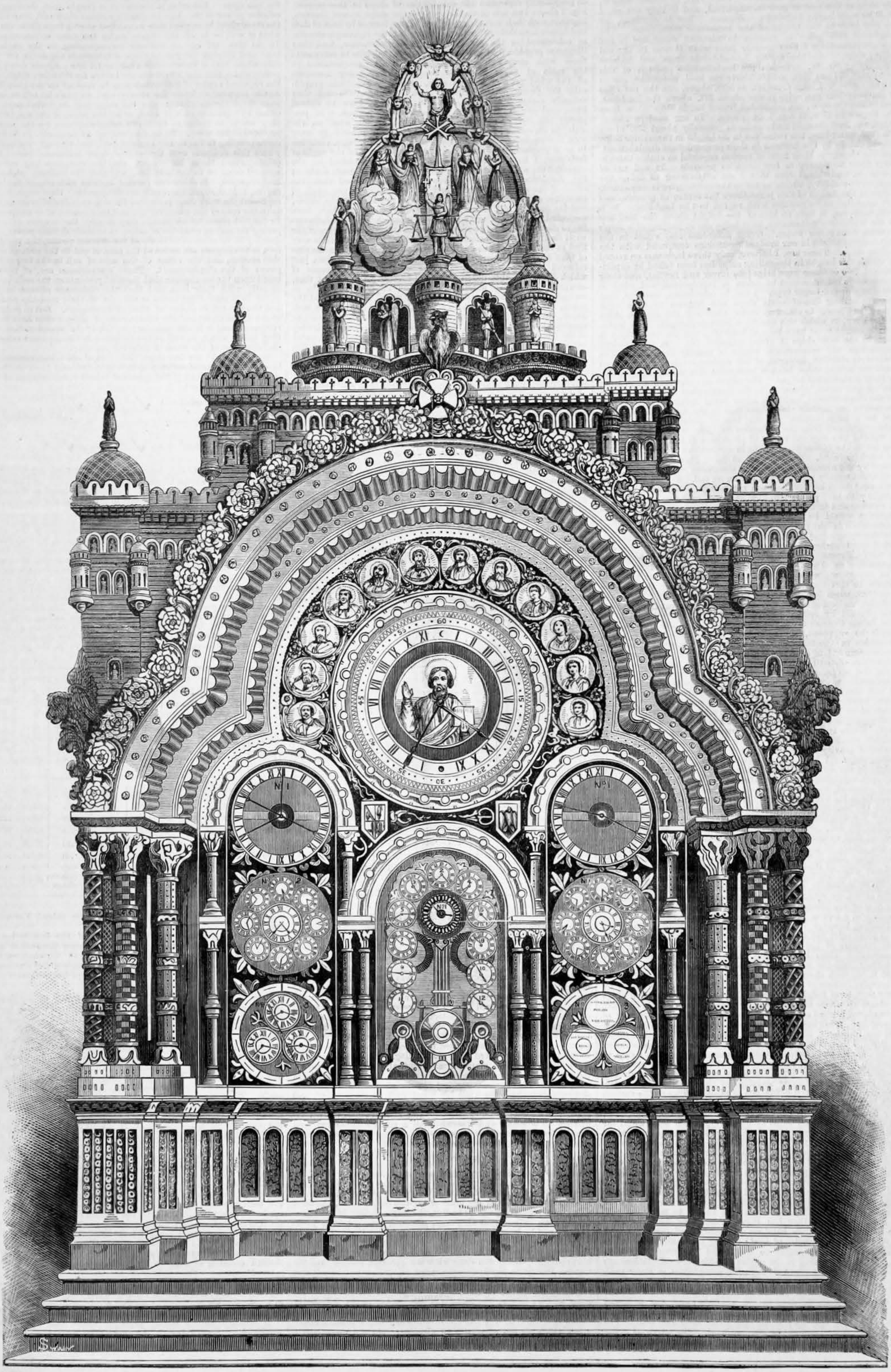
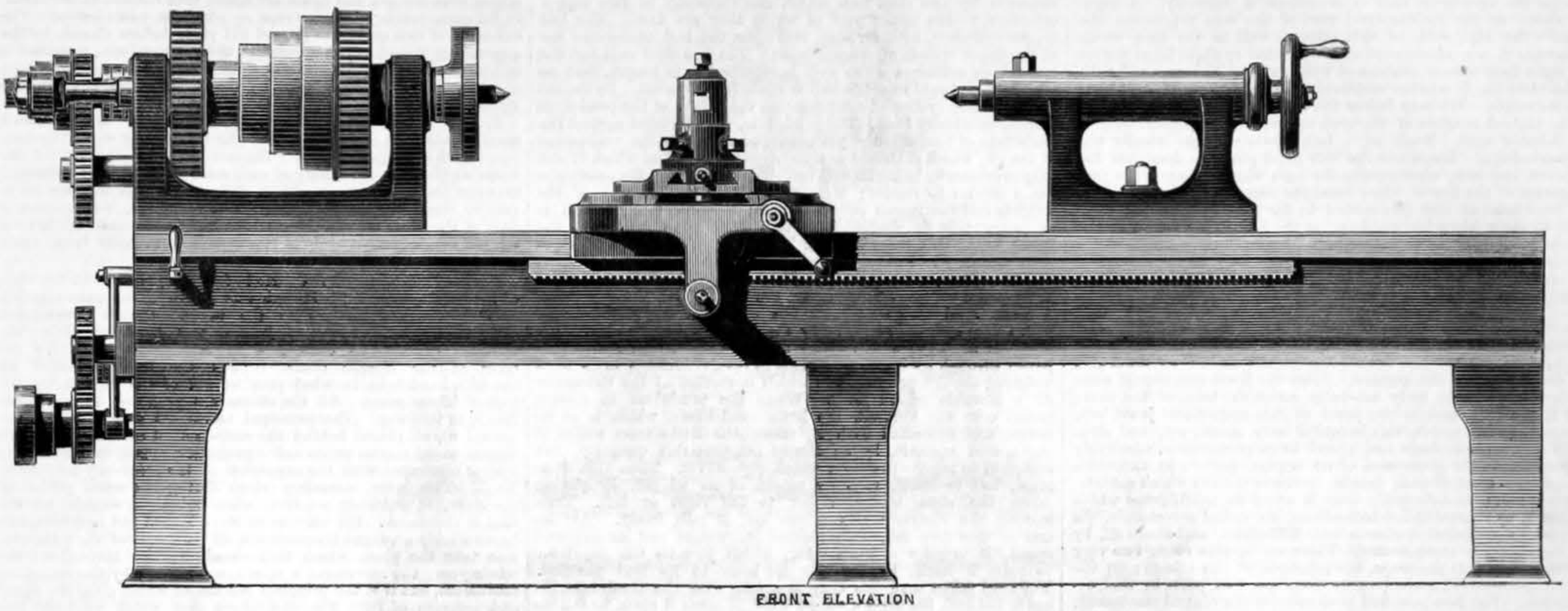
GREAT CLOCK FOR THE CATHEDRAL OF BEAUVAIS.

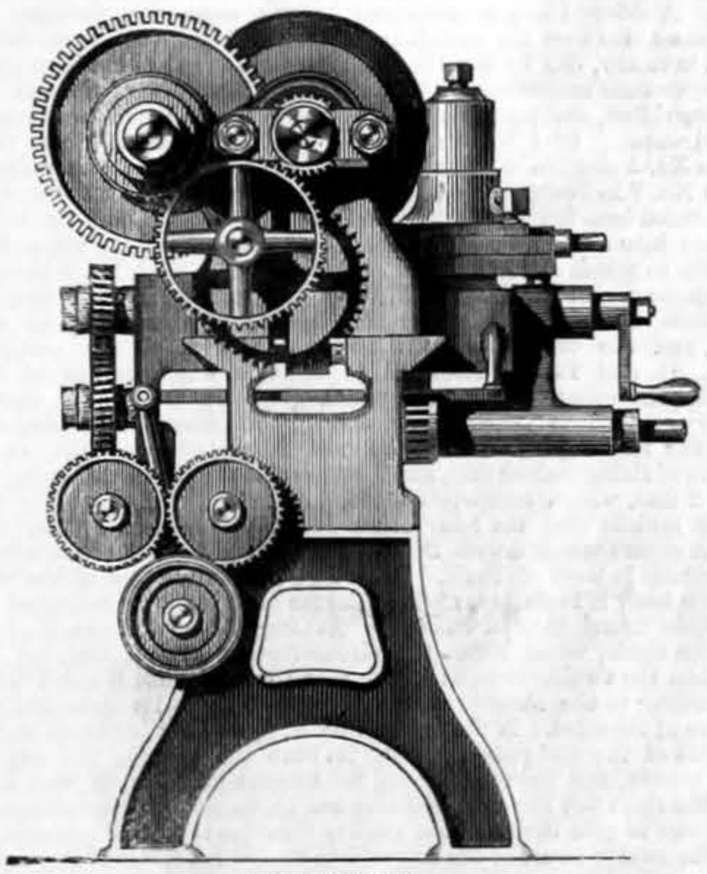


LATHE FOR TURNING SPHERES.

CONSTRUCTED FOR MESSRS. ROBEY AND CO., LINCOLN, BY MESSRS. HIND AND SON, ENGINEERS, NOTTINGHAM.



FRONT ELEVATION



END ELEVATION

WE illustrate above a special tool designed for turning governor balls or other spherical articles. It consists of a bed with a planed top surface V'd for a saddle, upon which are mounted a double-geared fast headstock and suitable loose head. The saddle is fitted internally with a worm wheel held centrally by a boss in the base of the saddle, and four V'd plates holding the slides down upon the saddle, allowing them to work free, but without any vertical play. The worm wheel is driven by a worm deriving its motion from gearing and traverse shaft at the back of the bed; the traverse shaft is fitted with reversing motion, and the belt cones are driven from the fast head spindle end. The worm wheel has a slide fitted to it for receiving a cross slide for the tool holder, thereby admitting of adjustment by the screw towards the centre. The tool holder is of the socket type, and is capable of being set to any angle. The tool can be traversed in either direction, and can be stopped instantly, the worm shaft being driven by friction cones to admit of its being worked self-acting or by hand. The saddle can be moved on the bed by rack and pinion movement. This tool will effect a great saving in large engine shops, such as Messrs. Robey and Co.'s and Messrs. Clayton and Shuttleworth's, as it will turn out a large number of governor balls in a very short space of time.

PENN'S PATENT REGULATING COCKS.

THE principal object of this invention, patented by Mr. S. Penn, of Westbury-street, Wandsworth-road, is to regulate the closing of water-closet and other cocks to give time for a certain quantity of water or fluid to flow through the cock from the time it commences to close until it is entirely shut off, at the same time preventing the cock from being injured by suddenly jerking it open.

Fig. 1 represents a cock mounted on a standard, partly shown in section, and a sectional view of the oil cylinder; Fig. 2 is a top view of the improvement. A is a standard made of any suitable length and by preference of iron tubing, to the top of which the stock B of the cock is attached as represented. C is the cock to which is attached the cross lever, E, F; to the E end of the lever is attached the weight J for drawing the cock close or shutting off the supply of water; to the same end of the lever is attached a piston-rod *k* working in the cylinder *g* through a stuffing box as represented; this cylinder will be filled with oil or other fluid if desired; the lower end of the rod *k* is furnished with a piston *f*, through which is made a suitable size hole *h* for allowing the oil in the cylinder to pass through it to regulate the closing of the cock; the piston *f* has a groove around its circumference for receiving a ring of leather or any other suitable substance for packing purposes. *m* is a support attached to and projecting from the standard A for carrying the cylinder *g*; the cylinder is so attached to this stem that it takes any position to suit the working of the lever E, F. The cock is represented closed, and in order to open it the E end of the lever may be drawn up by any suitable handle, rod, or cord, for working the same, or by drawing the F end of the lever down until it reaches the position denoted by the dotted lines in Fig. 1, when the cock will be full open for the passage of water as described by the darts. The cock is then closed by the weight J pulling the lever down, which in the meantime forces the piston *f* to the lower end of the cylinder; the movement of the piston downwards is regulated by the resistance of the oil in the cylinder passing through the opening *h* in the piston *f*; the time the cock C is kept open will depend on the size of the hole *h* for the passage of the oil; the larger the hole is the sooner the cock will close; the proper diameter of it will have to be ascertained by practice, for the various size cocks and quantity of water to be discharged in a given time. The cock may be placed in any position and employed for any purpose required, but they are more particularly intended to be used in connection with water-closets.

FIG 1

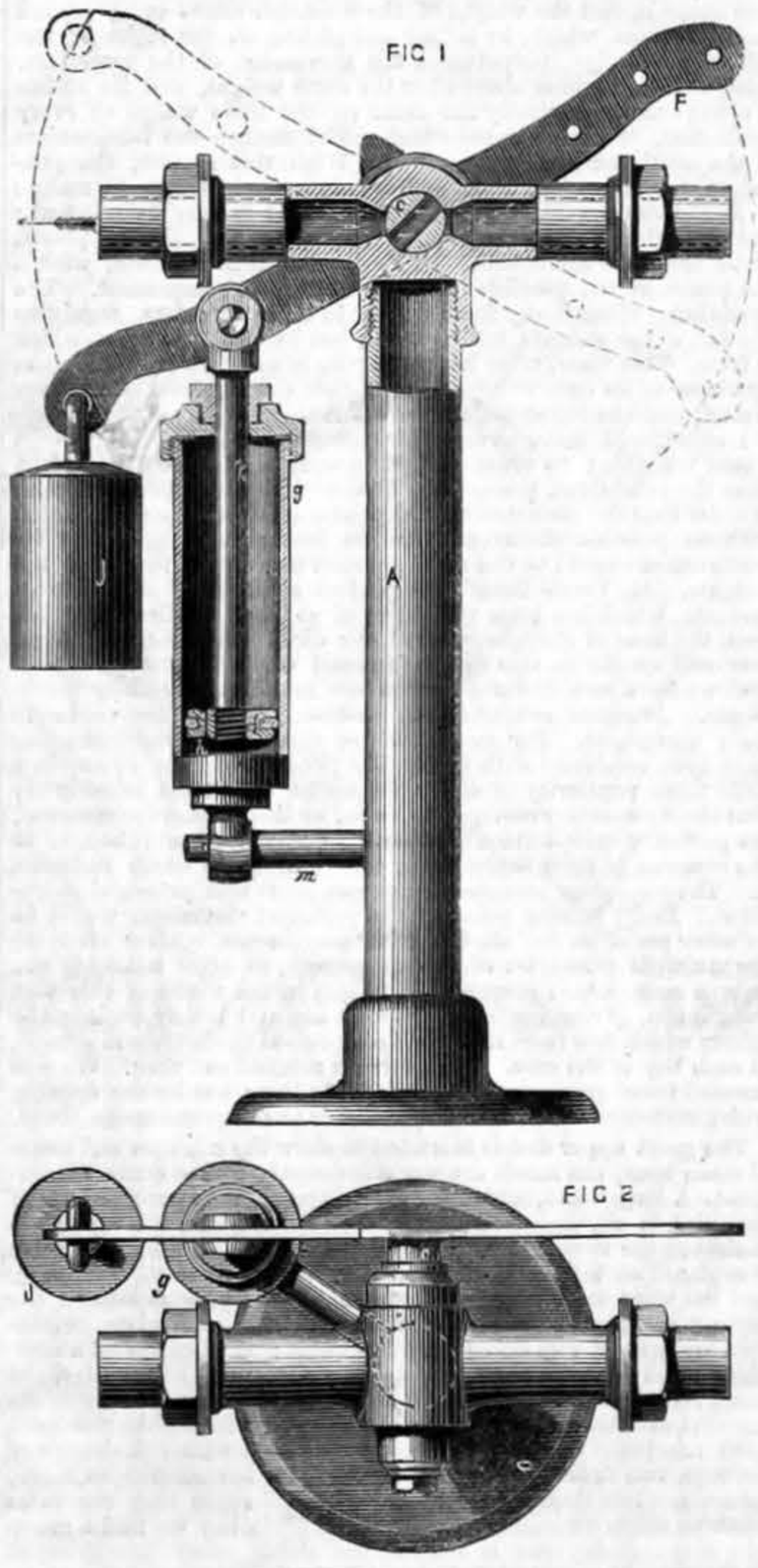


FIG 2

BEAUVAIS CATHEDRAL CLOCK.

THE construction of clocks constitutes a distinct branch of mechanical engineering, possessing no small interest for many minds; and this fact would in itself be sufficient excuse, were any needed, for the appropriation of a large portion of our space this week to an account of certainly the most remarkable clock that has been constructed within the last half century. This clock was exhibited at Paris in 1867. We are unable to say whether it has as yet been erected in its place, but we believe it is still in Paris, the war having interfered with the completion of the scheme of the Bishop of Beauvais. A description of this clock, from the pen of an author whose name has not reached us, was circulated in Paris in 1867. It is in many respects a literary curiosity. We have done our best to preserve as far as possible the spirit of the original in the following translation :—

"The first idea of this clock belongs exclusively to the Lord Bishop of Beauvais, who, justly proud of his beautiful cathedral, wished to endow it with a clock which, by its magnificent proportions and multiplied indications, should be an ornament worthy of that structure, that veritable *chef d'œuvre* of past times. The bishop's thought had only to be expressed to be immediately acted upon. Numerous ecclesiastics hastened to offer their assistance, too happy thus to attach their names to the execution of an exquisite work of mechanism and art. A commission was appointed; the artist was already pointed out, his talent commended—thus distinction and friendship selected him. We have named M. Verité. In a few days the work was begun. Everyone knows the glories and the misfortunes of the cathedral of Beauvais. The choir, by the noble and severe simplicity of its ornamentation—by, we might say its hazardous proportions so bold are they—may justly pass for the masterpiece of the thirteenth century. The sixteenth century achieved nowhere anything grander and more rich than the south porch. The north porch seems a sublime adieu made by art to Gothic traditions before casting itself headlong into all the decadences of that epoch which we have agreed to call the Renaissance. But, alas! the crumbling arches and tower rendered for ever impossible the construction of the grand nave of this cathedral, which had been so magnificently begun. So when the visitor, wonder stricken by the contemplation of the choir and the transepts, returns looking for the nave, his eyes are offended by a frightful wall, a work truly worthy of the period which best understood how to insult the middle ages. An immense ogive pierced in this wall will, we hope, be the frame of this monumental clock, and M. Verdier, the architect to the cathedral, has already adopted this idea. A *chef d'œuvre* of our times will thus be a pendant to the *chef d'œuvre* of past ages, and will console us for the absence of the grand nave."

Our author then proceeds with his description of the clock in the following words :—

"The case was executed according to the plans of R. P. Piérart, the pupil of the Rev. Father Martin, and the inheritor of his genius. It measures 39ft. 4½in. in height, 16ft. 9½in. in breadth, and 9ft. 3½in. in depth. It was conceived in the severe style of the Roman epoch, but in its decorations all the riches of Byzantine ornamentation have been exhausted. It is composed of two very distinct parts; the first is altogether architectural, the second especially symbolical. (1) Lower and architectural part of the case :—The base is a long square, and forms the ground plan of the case; and from this base rise solid pedestals which support four groups of five columns, on which rest the springings of a triple retreating archivolt, so that the case presents a porch on all its faces, having a depth of more than a metre, with an admirable perspective effect. On the side faces, the concentric archivolts show a triple semicircular arch, which, with its three columns, enshrines a bay of unique character. On the front and back faces the two archivolts which are on the first plane form a large trilobed arcade, the top of which is 26ft. 3in. from the ground. The third archivolt, which is on the last plane, only follows the two others in their first direction; it leaves them at the two internal points of the trilobe to describe alone the three semicircular arches which crown the great bays, piercing with open work the whole case. The middle one is about a yard less in height than the two others. The springings of the semicircular arches which crown these bays rest on a double series of four little superimposed columns. In the vast tympanum left free, and enshrined by the great trilobed arcade above the three bays, and in the same vertical plane, is rounded off a circle, the diameter of which measures 4. ft11in. The rich decorations of this circumference intentionally recalls the mind to the arches of the lower arcades. This is the great dial of the clock. Such is the inferior part of the case in its *ensemble*. Shall we now attempt to describe the ornamentation in its details? A mere nomenclature would be too long. The numerous panels of each pedestal are ornamented with flowered or flowerless bezants; a foliage boldly indicated rather than carved runs to the upper part of the base and crowns it. The great columns, thrice annulated with byzantine foliage, have their shafts covered with cable moulding, diamond points, palm leaves, diamanted billeted cables and billets. As to the capitals, deep carvings show their massiveness, and seem at a distance to give motion to them; on a nearer view the eye admires all the details, which are treated with scrupulous care. Nothing can be richer than the arches of the great arcades—roses, diamond points, saw teeth or damiers; all these decorations, forming a garland, cover the vertical planes of these covings. To finish his work the architect carried to the summit, on the extreme arris, a magnificent gallery of open sculpture work. Nothing can be more elegant than this crowning, which shows so conspicuously with a background of severe and quiet byzantine ornaments."

No portion of our author's description is more curious than that which refers to the symbolical character of the upper portion of the case. It is far too long to reproduce entire; we shall, therefore, content ourselves with a few extracts :—

"In the upper and symbolical part of the case Eternity is seen holding Time in subjection, and preparing to rule over him by justice, after having exhausted all his mercies in his favour. On the grand front façade, at the highest summit, in the midst of a great glory peopled with angels, appears our Lord, seated upon a rainbow; a simple cloud separates Him from Time, he touches its

frontier, His foot rests upon the globe of the world which He comes to judge. On the right and left of our Lord are seen the Virgin and Joseph. . . . . Whilst at the feet of the Redeemer of time we see the pendulum by its oscillations measuring seconds, minutes, and hours as ages, hands coming from the Divine heart seem to give through Him these seconds, these minutes, and these hours as the ages to all that exist outside of Eternity. A triple city seated on the architectural part of the case represents the world. The high walls of this city, as well as the keep which surmounts it, are ornamented and defended by eight large towers and eight demi-towers cantonned with turrets and crowned with machicolations. It is to the middle of this city that the river of time rolls its waves. We may follow the course of it from age to age. At the highest summit of the keep appears the representative of the Adamic ages. Noah on a less elevated plane recalls the patriarchal age. Moses and the four great prophets dominate the towers of the city, representing the ages which separate the promulgation of the law of Sinai from the coming of the Messiah; and the Christ at last surrounded by the four Evangelists, indicated by their historical emblems, at the four upper angles of the architectural part of the case, represents the Christian ages which still remain, and will end only with time. On the open bays of the cities are seen representatives of all the peoples of the world."

We shall now give a description of the mechanism of the clock in our author's own words :—

"The splendid construction we have just described is nevertheless but a frame. After the description of the frame we must give the description of the picture. After the jewel case should come the jewel, after the body naturally comes the turn of the soul; and M. Verité's clock is the jewel of this magnificent jewel box, the soul, which makes this beautiful body speak, act, and sing. M. Verité's clock, large and grand in its proportions, admirably harmonious in the disposition of its organs, perfect in execution even to the most minute details, ravishes the eye which contemplates it; but far differently does it affect the intelligence which studies it by its multiplied indications, its varied movements, the thousand vanquished mathematical difficulties, and above all, by its incomparable escapements. There are in this clock two very distinct parts: (1) the cause, the principle of the effects; (2) the effects themselves; consequently there are two parts in this description. The first part will be devoted to the central movement, to the regulator properly so-called, and to the secondary motors; the second portion will be filled with the description of all the effects produced immediately or mediately by the motors. But before entering upon the subject we have something important to say to the reader. A clock, like a musical instrument, has a true diapason according to which it is attuned. This diapason is called a calendar, and as regards M. Verité's clock it is the Gregorian calendar. All the world knows the history of this calendar. Its founder was Julius Cæsar, its reformer Pope Gregory XIII. In the year 45 before Jesus Christ, Julius Cæsar caused the civil year to begin on the 1st of January, ordering that for the future the year should be counted by periods of four; the three first 365 days long, and the fourth 366, which should be bisextile. Compared with past ages, this calendar of Cæsar's was an immense progress, but contained too serious an error to avoid for ever new intercalations. In fact, in the sixteenth century it was perceived that the equinoxes preceded by ten days the 21st of March and the 21st of September. Pope Gregory XIII. in 1582 remedied this perturbation. By a Bull he shortened the year 1582 by ten days, and the 5th of October became the 15th; harmony was re-established between the year and the course of the stars. But the cause of the error existed still, and in the impossibility of getting rid of it it was necessary to lessen it. The Pope then, keeping to the Julian intercalation for each period of four years, modified it for the secular years. All the secular years after the Julian reform were to be bisextile; there is no longer more than one in four since the Gregorian reform. Doubtless even this disposition only establishes an approximative harmony between the year and the course of the stars; but the difference is so far diminished that it would require a revolution of four thousand years to give it the value of a day, and it would be easy to maintain this limit even for a period of a hundred thousand years. This Gregorian reform then, is, as we have said, the diapason of the clock which we are about to describe. In this clock there is a central movement which may be named the general regulator, and fourteen secondary movements. And first of the central movement and regulator. Every regulator is composed naturally (1) of a weight which falls, or of a spring which relaxes; (2) Of an apparatus which regulates these movements. The weight or the spring perpetuates the movement of the regulating apparatus, which in return itself regulates the essentially varied movements of the spring or of the weight. The weight or the spring is naturally called the movement; the regulating apparatus is always composed of two pieces, which each has its name. The first is the pendulum; the second the escapement. The movement is in the middle of the great bay of the posterior façade. It is firmly placed on the cases of two other movements, which serve it for a pedestal. Not a movement takes place in the clock, no indication is given, which does not emanate directly or indirectly from this movement. Its construction, therefore, required particular care. In order to diminish by half the pressure on the pivots, the motive force is divided into two. There are then two weights and two driving barrels in this movement. That the action of the motive force may not be suspended, even during the winding-up, each cylinder carries a rachet enclosing an auxiliary spring, which keeps up the movement of the wheels while the weight is being raised. The last wheel which moves under the direct action of the weight is armed with a fly, and it causes a regulator to act, which itself, by one of its parts, impresses the movement on the escapement.* In the midst of the principal movement there is a mechanism known under the name of *depart*. This *depart*, making one turn per hour, is composed of two discs placed upon the same axis, and in parallel planes. The first, which receives its motion from the principal movement, communicates it to the second by means of a spring and detent, the head of which is fixed in one of the sixty notches which indent the circumference of the second disc. The second disc, by the aid of a bevil wheel fixed to its centre, itself radiates motion to the hand wheel work throughout the whole clock. These two discs, then, act from the same movement, coupled as they are by the spring detent which is fixed to the first disc, and the head of which is fixed in one of the notches of the second. But such being the fact, it is easy to understand that if, after raising the head of the detent, we cause one disc to turn either forwards or backwards, so that the detent fits into the notch either on the right or left, we shall have put all the dials fast or slow by a minute, whether the revolution of their hands take place in an hour or in thousands of years. This central movement communicates the movement—1st, to all the hands which point out the hour on more than twenty different dials; 2nd, to the sun and moon, which gravitate around terrestrial globes; 3rd, to hands which indicate sidereal time; 4th, to two planispheres; 5th, to the planeterium which represents the eclipses of the sun; 6th, to the hands of the repeating dial placed behind the clock; 7th; finally, to the single hand of the little seconds dial, placed, so to speak, upon the floor of the clock, below the pendulum, whose oscillations it numbers. To produce all the effects that we have just pointed out, the two weights of the principal movement would suffice; but these two weights left to themselves would drag the whole system into a disordered movement; their descent must then be brought back to the march of time. The pendulum with its ball weighs 106 lb. Each of its oscillations should measure a second. To obtain this effect invariably, in spite of all the variations of temperature, a perfect system of compensation was necessary. The system is double; we will tell why presently. With the aid of nine rods, five of which are of steel and four of copper, the length of the pendulum will remain invariable, under all temperatures, from the centre of suspension to the superior part of the ball. As the ball cannot be attached to the rod of the pendulum by its centre, as that is the place reserved by the artist for the escapement, a particular system of compensation was required for it. It is taken hold of, at the two extreme points of its horizontal diameter, by two steel rods which rise vertically in two copper cylinders, to the upper part of which they are fixed. The two copper cylinders, by their base, rest upon the last transverse bar of the upper system of compensation. The two steel rods and the two copper cylinders are so well harmonised as to length, that no temperature could raise the ball or cause it to descend. By the aid of this double system of compensation the length of the pendulum is mathematically fixed. The pendulum, thus fortified against the variations of temperature, yet cannot be so against the resistances of the air, which it should necessarily overcome, and which it can only overcome by losing its own movement. Further, the pendulum has a service to render; it must regulate the descent of the weights and the march of the central movement. Now, it is necessary that it should fulfil this office as to the fall of the weights, and that these weights, in their turn, should give back to it what it may lose of movement by the resistance of the air, at the same time preserving the perfect isochronism of its oscillation! We touch upon the veritable gem, the soul of M. Verité's clock. A little steel wedge occupies the centre of a groove in the ball, and is embodied with it by the aid of a copper rod, which supports it. Above this wedge and on the vertical line which passes through its centre when it is at rest, is found a little mass weighing about a gramme, and which is carried at the extremity of a movable geared lever. When the pendulum in motion passes over the vertical, the little steel block, which is at its centre and embodied with it, raises the little mass which is superposed upon it, by an almost inappreciable quantity, but sufficient to release the lever which supports it. Then this little mass, left to itself, falls by reason of its weight, by gliding down the steel wedge, either to the right or left. Then leaving the wedge, which moves on, it falls freely. At the end of this free fall, by virtue of its weight and its acquired speed, it ungears a fresh lever, which permits the regulator to raise it itself, by bringing its lever to its first position. The steel pallet then has only to return with the pendulum, in order to touch the mass a second time, to cause it again to fall so as to receive a fresh impulse, whilst it will of itself cause its being raised again by falling a little lower. It is easy to comprehend that, by this admirable combination, the weights of the principal movement, the action of which is fatally variable, act no longer directly on the pendulum to perpetuate its movement. Their further mission is only to raise the weight of the *remontoir* every four seconds, and the weight of the *remontoir* raises every second the little mass, which, by falling and gliding on the right or the left of the wedge, perpetuates the movement of the pendulum. Now, this little mass always has the same weight, and its action is always mathematically the same on the little wedge at every oscillation. So every cause which might disturb the isochronism of the oscillations has disappeared. With this system, the pendulum, to receive this impulse, has only a single effort to make: it must raise the little mass, in order that it may be released; but this effort is ever rigorously the same, and always placed under the same conditions. M. Verité has then realised, within the limits of the possible, the constant force escapement. The pendulum, without any fresh danger to its isochronism, regulates the fall of the weights, not by itself, but by the little mass which it frees. This mass, after impressing its impulse on the pendulum by virtue of its own weight alone, makes the regulator move every second, and the latter makes the whole mechanism of the principal movement move every four seconds. The problem to be solved was this: to separate and completely isolate the weight from the pendulum, preserving, however, their reciprocal action, in order that the movement of the pendulum should be perpetuated without possible disturbance in its isochronism, and that its isochronism should be the mathematical measure of the fall of the weights. M. Verité found the perfect solution of this difficult problem, which has been the object of so many studies and trials from the time of Huyghens until our days. This solution lives, acts, and speaks in this clock. Around the principal movement that we have just described there are fourteen secondary movements. Weights set them in motion, simple flies moderate their movement. For two of these movements only the flies have been combined with the conical pendulum, so as to secure a little more regularity in their movement. We need scarcely say that these secondary movements, so far as their action is concerned, are perfectly independent of the principal movement; but, as to the moment of their action, it is that movement which indicates it. The secondary movements act not from this principal movement. Every halting point of the principal movement would be an utter paralysis for all the other movements. After studying the multiple principles of the movement, as after admiring the unique cause which governs and reigns in the midst of this vast mechanism, it remains for us to point out and briefly explain the effects which flow from it. The dials present themselves in groups, in each bay of the case. Our course is marked out then. We will proceed from group to group, pointing them out by the opening which enshrines them, to rise afterwards to the grand scene above.

The great upper dial is intended to show the minutes and hours of mean time, the hands are worked directly by the central movement. A large band, which forms, as it were, the circumference of the dial, is divided into twenty-four medallions, on which are indicated the twenty-four hours of the day. The number twelve is replaced on the lower cartouche by the word *midi* (mid-day), and the word *minuit* (midnight) replaces the figure twelve on the highest medallion. The minute hand makes a complete revolution every hour, and counts sixty minutes; the hour hand a complete revolution in a day, that is to say, in 1440 minutes, the exact measure of a mean day. By mean time is understood the uniform division of all the days of the year, which gives for each 1440 minutes. True time, or the real day which passes away between two successive risings of the sun, has sometimes more, sometimes less than 1440 minutes; the difference may rise to as much as thirty-two minutes. In the middle bay we find a group of a dozen dials; one is central, the eleven others are grouped around it. The central dial gives all the indications of the ecclesiastical computation. Five hands come from its centre, and each of them is the radius of one of the five concentric circles designated on its surface. On the greater circle we find in figures the twenty-eight indications of the solar cycle; on the second circle the series of dominical letters; on the third circle, the nineteen indications of the golden number; on the fourth circle the epacts; on the fifth and last circle are finally the fifteen cyphers of the Roman indiction. Each indication is in white enamel, and admirably relieved by the blue ground of the dial. Each hand is terminated by a golden ring, and every year, on the 31st of December, at midnight, it is by this golden ring that each hand incloses the cypher, or the letter which it is to designate throughout the year. The function of each hand is besides inscribed on its golden ring. A few brief details as to the indications will, perhaps, not displease the reader.

The Solar Cycle, which began nine years before our era, is a suite of periods of twenty-eight years, at the end of which the year recommences always by the same days.

The Dominical Letter.—One of the first seven letters of the alphabet has been given to each day of the week, so that A indicates the 1st of January in the development of the solar cycle. From this it follows that the same letter indicates the same day throughout a whole year, and that there is a letter which, each year of the solar cycle, indicates Sunday. The solar cycle consisting of a period of twenty-eight years, there is then a dominical letter for each of these years; it is precisely this letter which is incased by the twelfth hand in its golden ring. As regards the bisextile years, there are two dominical letters. The first serves from the 1st of January to the end of February; the second from the 1st of March to the 31st of December.

The Golden Number.—As there is a solar cycle, so also is there a lunar cycle; this cycle comprehends a period of nineteen lunar years, that is to say, 235 lunations, at the expiration of which the new and full moons happen at the same times, for the very simple reason that the sun and moon are again, with respect to the earth, in the same points of the heavens as nineteen years before. The existence of this cycle was proved 433 years before Christ, by the astronomer Meton. The Greeks, in their enthusiasm, inscribed it in letters of gold on the walls of their temples; thence the golden number. The third hand, then, by the figure which it surrounds by its golden ring, tells the age of the lunar cycle.

Epacts.—By epacts is understood the number of days which must be added to a lunar year in order that it may equal the solar year which corresponds to it. The number gives the age of the moon on the first of January of each solar year. As the difference between the two years is eleven days, the epacts increase every year by eleven days, until they pass twenty-nine, the number of days of the lunar month. We then suppose the intercalation of a lunar month. This cycle of epacts expires with the lunar cycle of nineteen years, to recommence again.

Roman Indiction.—It is a period of fifteen years. At the time of the Julian reform this indiction served to fix the promulgation of certain edicts relative to the taxes. Under Constantine and his successors the indiction was used to date the tribunal decrees, as even now it is used to date the decrees of the Roman court. Thus the letter enclosed by the fifth hand tells in what year we are of the present revolution of fifteen years. All the effects are produced by movement No. 5, in this way. The principal movement sets in action the annual wheel, placed behind the ecclesiastical computation; this annual wheel carries on its axis a projecting spiral, on which rests a lever connected with the expansion of the secondary movement No. 5. This lever, insensibly raised during the whole period of the year, is suddenly set free, when midnight sounds on the 31st of December. The movement No. 5 is then put in action, and by a suitably arranged transmission all the hands of the computation take the place which they should occupy throughout the whole year; the movement is then accomplished by the secondary movement, but it is the principal movement which gives the signal and measure of it. The dial above that which we have just described, and on the same vertical, gives the hour of the sidereal day. A sidereal day is measured by two successive passages of the same star over the meridian. Dial No. 3 gives solar equation, that is to say, day by day the difference which exists between true time, or time measured by two successive comings of the sun to the meridian, and mean time of the day measured by a well regulated watch. Dial No. 4 shows the sun's declination. The two dials No. 5 and No. 6 show the lengths of the days and nights. Dial No. 7 indicates the seasons. The circumference of this dial is divided into four, each division indicates a season, and the hand enters into one of these divisions, or emerges from it, when the season to which it corresponds begins or ends. Dial No. 8 has on its circumference the twelve signs of the zodiac. Nos. 9 and 10 indicate, one the hour and the minute of the rising of the sun, and the other, the hour and the minute of his setting. Nos. 11 and 12 are intended to indicate, one, the day of the week, the other, the planet which gives that day its name. Every midnight each of these hands advances a degree. In the left bay the first dial not only indicates the sun's hours of rising and setting, but it represents the phenomenon itself. No. 2 dial, which comprises a group of nine dials, shows, by the great middle dial, the hour of the meridian of Paris, and by the eight others which crown it, the hour at eight great cities whose longitude is west of Paris. Each dial bears the name of the city whose hour it indicates, and the degree of this city is indicated by a little inscription in enamel. As regards No. 3, on a great golden circle, which forms the circumference of this dial, are inscribed the twelve months of the year; each month is subdivided according to the number of its days, and bears its date and the name of its saint. A long hand carried upon an axis placed in the centre of the dial points out by its barb the month, the day of the month, and the saint whom the Church honours on that day. In the right bay the first dial also has on its greater circumference a crown of gold divided into twenty-four parts which correspond to the twelve hours of the day and to the twelve hours of the night. The moon, borne on the extremity of a long and movable rod on its two points of attachment, passes round the circle thus divided. In the centre of the dial is seen a terrestrial globe with its golden ring representing the meridian of Beauvais; a style coming from this golden ring, and stretching out in its plane, cuts the circle around which the moon passes. This arrangement enables us first to observe the different phases of the moon, secondly to show the true motion of its passage to the meridian of Beauvais. The second dial comprises a group of nine dials, one central, and the eight others encircling it. Each of these dials gives the hour and minute of the nine great cities which are east of Paris. The central dial shows the hour at Rome. Each dial bears the name of the city to which it is devoted, and a little enamel indicator shows on what degree each of these cities is placed. A large golden circle surrounds the third dial. This circle is divided into twelve parts, each of which corresponds to one of the months of the year. Each division is subdivided into as many parts as the particular month has days; each day bears its date, the name of its saint, or of a fixed feast. The circle thus divided is only a sort of perpetual calendar, on which every year the movable feasts will each show its day. Round the centre of this great dial there are three other small dials, on a blue ground. All three are furnished with wickets. The first of these dials indicates the books of the old testament according to Moses; the second indicates the date of the current year, and whether the year is common or bisextile; finally, the third, the current century, and whether it is bisextile or not. The dial in the right lateral façade is devoted to the representation of the eclipses of the sun—the artist has purposely omitted the eclipses of the moon, for as this phenomenon takes place at night, the representation would not have been visible.

A distinguished artist, M. Thierrée, of Beauvais, wished, to please the bishop, to paint Mount St. Michel and the neighbouring waves. Heaven and earth are movable in the landscape. The sky slowly progresses from the east to the west, and thus brings successively over the port the aspect of the tempest and fine weather. With the tempest the sea becomes rough, and the ships are tossed upon the raging waves; but when the sky becomes serene calm is restored to the sea, and the waves simply rock the ships they bear. These motions are produced by movement No. 7, which has a conical pendulum. Less the painting, which is admirably executed, it is a little decoration and *mise-en-scène* in the midst of a world of works of precision. The mathematical part of this dial is the reproduction of the phenomenon of the tides as they take place exactly at the same time as at the port of St. Michel. The sea rises for a quarter of a lunar day, to retire afterwards for the same space of time; we then see the shore and the rocks becoming bare to the very limits of the low tide, and then the waves rise again. We all know that two successive tides do not have the same level; we can follow this phenomenon on the dial, and see the level rise or fall by degrees, according to the age of the moon. Beneath the last waves a very small dial is placed. Every day, at midnight, the two hands indicate the hour of high water for the day. Movement No. 15 governs the two hands and gives the tides their fulness. The going and coming of the waves is effected by the conical balance movement No. 7. Dial 3 is composed of two parts, the one fixed, the other movable. The fixed part presents first a great circle divided into twenty-four hours mean time, then a screen, in which an opening indicates the horizon to every observer at the zenith of Beauvais; a silk thread shows the meridian of this city.

The first dial in the left lateral façade has a planetarium

* [In other words, the clock is fitted with a *remontoire*.—Ed. E.]

according to the system of Copernicus. The second dial represents the same phenomena as dial No. 2 of the right lateral façade, the scene only is changed, and we look upon the port of Jersey and the Chateau de Montorgueil. The third dial is the exact *fac simile* of dial No. 3 of the right lateral bay. It is destined to the same observation, only the scene is changed, and these observations are made in the southern heavens, at the nadir of Beauvais. It contains 100 constellations, about 4000 stars, and 500 groups of stars and nebulæ.

Strikings.—Motors Nos. 2 and 3 produce all the strikings from the principal moter, by which they are themselves governed directly. A single stroke on the bell, giving ut, indicates the first quarter of an hour; three strokes, giving ut, mi, sol, indicate the third quarter; the perfect accord, ut, mi, sol, ut, tells that the hour is accomplished. A bell giving the sol at an octave below that of the bells of which we have just spoken counts the hours.

The motor No. 9 causes one of the four angels of life to come from the keep, beginning with infancy, on the striking of each quarter. The motor No. 4, governed directly by the principal motor, an instant before the striking of the hour makes the cock crow three times in the midst of many movements, imitating nature as closely as possible. Scarcely has the last stroke of the hour sounded than the motor No. 13 raises the hand of the Christ, who by a sign of the head gives his angels the order to announce his judgment. At this moment the motors No. 9, 11, 12, and 14, give or give back again the movement in turns or simultaneously by twos or threes, and the whole scene of the last judgment is accomplished. The eye follows all these movements with difficulty, the pen refuses to describe them. Over the principal motor may be seen an electrical commutator. This commutator would enable M. Verité to keep mathematically to the rate of his regulator all the clocks of Beauvais.

In conclusion, we would name the artists who have principally assisted in the construction of this clock. In the mechanical part, M. Aug. Beaudorim, M. Verité's foreman. For the statues, M. Constanciel, pupil at the School of Fine Arts, Paris. The decoration, Frère Arthémé, assisted by M. Lenormand, decorative painter of Beauvais. We must also name M. Fontaine, of Beauvais, who executed with remarkable talent part of the carvings."

We think our readers will agree with us that the clock thus graphically described with all the energy of a Frenchman really deserves to be regarded as one of the most remarkable specimens of horology in the world. Whether it does or does not represent an enormous amount of misdirected ingenuity as well, our readers must decide according to their individual proclivities.

PRIVATE BILLS IN PARLIAMENT.

ON Monday week proceedings were commenced in Mr. Hardcastle's Committee, Group 1, upon one of the most important bills, or rather, pair of bills, of the session—the Mid-London and the Mid-London (Western section). These bills are supported by Mr, Rodwell, Q.C., Mr. Serjeant Sargood, the Hon. Mr. Thesiger. Mr. Gorst, and Mr. Kingsford, with Mr. Henry Toogood as agent. These gentlemen and the petition they supported have in opposition fifteen Queen's counsellors and counsel, and a large host of agents, concerned in supporting no fewer than sixty-two petitions against the bills. It is scarcely necessary to recall the fact that these bills are for a line of railway to pass through London between east and west, from Whitechapel to Holborn, the Marble Arch, and thence in a direction nearly parallel with the Edgware-road to Willesden junction. Many of the petitions are from highly influential and powerful associated bodies, companies, and owners of property, and some of them from persons unknown to fame. The petitioners against the bill include the Lord Mayor, Aldermen, and Corporation of the city of London; the Ecclesiastical Commissioners of England, the Marquis of Westminster, Lord Portman, and many vestries and owners of property, with several of the principal railway companies. Mr. Rodwell Q.C. opened the case for the promoters in a speech that lasted for nearly three hours. The case occupied the attention of the Committee every day during the remainder of the week: the principal witnesses that have been called by the promoters having been Mr. Wm. Casey, a traffic taker; Mr. Forbes, general manager of the London, Chatham, and Dover and Metropolitan District Companies; Mr. Caukwell, general manager of the London and North-Western Company; Colonel W. R. Strange, of Maida Hill; Rev. David Rowe, vicar, Kilburn; and Mr. Haywood, C.E., engineer to the Commissioners of Sewers of the city of London.

The proposed new street from the junction of Giltspur-street and Newgate-street to Commercial-street, Whitechapel, is, it will be remembered, an important feature in this project, the intention being to construct the railway and open up the street by one series of connected operations. The proposed new street is regarded with great favour by the owners and occupiers of the densely planted warehouses in the streets to the north of Cheapside. Meetings have been held that have been attended by the representatives of many of the most important firms in the City, and strong resolutions have been passed in support of the Mid-London Bill. Sir Thomas Chambers, Q.C., M.P. for Marylebone, has attended and given evidence in favour of the bill on behalf of an influential section of his constituents. Mr. R. W. Crawford, one of the members for the city of London, has also given evidence in favour of the bill. Mr. Samuel Morley has given evidence in favour of the bill, not on behalf of his parliamentary constituents, but as the representative of a large number of his neighbours in Wood street and the district, who met, and under his presidency, passed strong resolutions in favour of the Mid-London scheme, and requested him to attend the committee on their behalf, and give evidence in its favour. Witnesses have also appeared in support of the scheme, who represent some of the most important firms, having their places of business on or near the line of route of the proposed railway. Among these are representatives of Poland, Furriers, Gillon and Son, Crosse and Blackwell, Bonsor, Taplin, Goslett, Allen, Dalziel, Bradbury, Greatorex and Co., and E. and R. Vigers. Mr. Brett, from Pickford and Co., the great carriers, also supported the bill by evidence; and Mr. H. P. Bruyeres, superintendent of the southern division of the London and North-Western Railway.

The engineering witnesses in support of the Mid-London bills have been Mr. John Hawkshaw, Messrs. T. H. Falkiner, T. E. Harrison, and J. F. Blair.

The Severn Railway schemes, of which six were started, are now reduced to two, the Severn Tunnel and the Severn Bridge (No. 2), the last of which occupied the first five days of last week. The Western Junctions Bill was for some reason withdrawn after it had reached the Committee: it would, it was supposed, have had a fair chance of success if it had been persevered with. It was proposed by that bill to cross the Severn in the same locality as by the Severn Bridge (No. 2) scheme, at Sharpness Point, but at nearly right angles with the river, instead of being very much on the skew as proposed by the project last referred to. A large number of witnesses for and against the bill were examined on matters of engineering, interference with the navigation, damage to property, and other points. The bill has been passed by the Committee. The Severn Tunnel scheme has now passed the Committee stage in both Lords and Commons unopposed.

In Mr. Dent's Committee, Group 5, the business since our former notes has included the hearing of the North Wales narrow gauge, and the London and North-Western Railway bills. The last is an additional powers bill, and includes the construction of twenty miles of new line, on a 2ft. gauge, in North Wales. The North Wales narrow gauge line is for the construction of seventy-seven miles of narrow gauge line, part of which would duplicate the proposed line of the North-Western. The Committee rejected railways 1, 2, 4, and 8 of the North Wales narrow gauge line, but reported in favour of railways 5, 6, and 7. The London and North-Western bill was passed almost in its entirety, the only exception being the proposed stoppage of a foot path at Willesden which is not sanctioned by the Committee.

Prolonged contests have occurred in connection with the Doncaster Water Bill, Group D, which has been rejected by the Committee in a special report, in which the attention of the Board of Trade is called to the defective water supply of Doncaster; the Rochdale Improvement Bill, Group F; and the Rhyl Improvement Bill, Group G. The two last relate chiefly to projects for sewering the towns. The Rochdale Bill is promoted by the corporation, and has to meet the determined opposition of Lord Derby and the Earl of Wilton as owners, and that of the inhabitants of Rochdale generally.

In last session a keen contest occurred in connection with a proposed direct line between Ryde and Newport, Isle of Wight. The bill is for a line of seven miles sixty-eight chains, capital in shares and loans, £66,600. Although only a comparatively small affair, the project caused a keen contention, the Newport Junction Company, whose works are in progress, being the principal opponents, on the ground that there is no need for the proposed line, which would compete for the traffic that they (the Newport Junction Company) were perfectly competent to accommodate. The proposed line will be about five miles shorter than the route from Ryde *viâ* Brading and Landown, and the Newport Junction to Newport. Last year the bill, after being contested and passed in the Lords, was rejected by the Commons' Committee. This year again the bill has been passed in the Lords' Committee, the Duke of Grafton presiding, and once more advantage will be taken of the opportunity for a rehearing, and the bill will be again fought in the Commons.

In Lord Henley's Committee, Group D, the inquiry concerning the Birmingham Sewage Bill is, as was expected, causing much excitement. The evidence is very voluminous, and opens up all the varied phases of the important treatment of sewage question. A glance at the salient points of the evidence must be deferred.

In Mr. Dent's Committee, Group 5, the opposed cases of the Lancashire and Yorkshire New Works and Additional Powers Bill has been examined and reported. The new works include seventeen miles eight chains of new line, and the raising of £1,730,000 of additional capital. Also the Cheshire lines Committee Bill, for a line from Stretford to Manchester, and two short railways at Warrington; new capital, £666,000.

THE INSTITUTION OF CIVIL ENGINEERS.

THE annual dinner was held at the Queen's Concert-rooms, Hanover-square, on Wednesday, the 24th of April, 1872, the President, Mr. T. Hawksley, being in the chair. The company actually present included the following guests:—H.R.H. Prince Arthur, K.G., the Right Hon. A. S. Ayrton, M.P., Sir Julius Benedict, Mr. E. F. Boyd (Pres. Mining Engineers), Mr. Baron Bramwell, Dr. Burrows, F.R.S. (Pres. Coll. Physicians), Mr. G. Busk, F.R.S. (Pres. Coll. Surgeons), the Earl of Caithness, Professor Cayley, F.R.S. (Pres. Astron. Soc.), Major-General Sir F. Chapman, K.C.B., Mr. Henry Cole, C.B., the Earl of Devon, Col. Sir H. Elphinstone, K.C.B., Mr. Fitzgerald, Mr. J. A. Froude, Sir John Gilbert (Pres. Water Colours), the Right Hon. W. E. Gladstone, M.P., the Right Hon. G. J. Goschen, M.P., Lord Richard Grosvenor, M.P., the Rev. H. Howarth, B.D., Dr. Joule, F.R.S., Lieutenant-General the Hon. Sir James Lindsay, K.C.M.G., Mr. Justice Lush, Lord Lyttelton, the Right Hon. W. Monsell, M.P., Sir Harry Parkes, K.C.B., Major-General Sir Henry Rawlinson, K.C.B. (Pres. Geog. Soc.), Lord Redesdale, Admiral Sir Spencer Robinson, Major-General Scott, C.B., Mr. W. Spottiswoode, F.R.S. (Pres. Math Soc.), Sir Charles Wheatstone, F.R.S., Mr. T. H. Wyatt (Pres. Architects). Members: Mr. J. Abernethy, Mr. Adams, Mr. R. Aitken, Sir W. G. Armstrong, C.B., F.R.S., Mr. J. Ayris, Mr. W. Baker, Mr. F. D. Banister, Mr. W. H. Barlow, F.R.S., Mr. J. W. Barry, Mr. J. F. Bateman, F.R.S., Mr. J. W. Bazalgette, C.B., Mr. G. Berkley, Mr. F. J. Bramwell, Mr. R. P. Brereton, Mr. H. Brothers, Mr. G. B. Bruce, Mr. J. Brunlees, Mr. J. H. W. Buck, Mr. R. H. Burnett, Mr. J. O. Butler, Mr. C. E. Cawley, M.P., Mr. J. Church, Mr. E. Clark, Sir John Coode, Mr. E. A. Cowper, Mr. J. N. Douglass, Mr. G. Elliot, M.P., Mr. J. Fowler, Past Pres., Mr. W. Froude, F.R.S., Mr. R. W. Graham, Mr. C. H. Gregory, Past Pres., Mr. T. E. Harrison, Vice-Pres., Mr. J. Hawkshaw, F.R.S., Past Pres., Mr. C. Hawksley, Mr. T. Hawksley, (President), Mr. G. W. Hemans, Vice-Pres., Mr S. W. Johnson, Mr. R. Jones, Mr. T. N. Kirkham, Mr. J. Kitson, Mr. W. B. Lambert, Mr. W. Lawford, Mr. W. Low, Mr. G. Fosbery Lyster, Mr. A. K. Mackinnon, Mr. J. A. M'Connochie, Mr. C. Manby, F.R.S., (Hon Secretary), Mr. P. J. Messent, Mr. J. Mitchell, Mr. A. Muray, C.B., Mr. J. Murton, Mr. A. S. Ormsby, Mr. W. Pole, F.R.S., Mr. A. Prentice, Mr. L. W. Pritchard, Mr. J. R. Ravenhill, Mr. J. B. Redman, Mr. O. C. D. Ross, Mr. J. D'A. Samuda, M.P., Mr. B. Samuelson, M.P., Mr. W. Shelford, Mr. Carl Siemens, Mr. William Siemens, F.R.S., Mr. H. Lee Smith, Mr. J. F. Spencer, Mr. H. P. Stephenson, Mr. T. Summers, Mr. G. Turnbull, Mr. F. T. Turner, Mr. A. Upward, Mr. C. B. Vignoles, F.R.S., Mr. Henry Vignoles, Mr. R. Price Williams, Mr. J. T. Woodhouse, Mr. E. Woods, Mr. O. Younghusband. Associates: Mr. W. A. Adams, Mr. J. Aird, jun., Mr. J. L. Ashbury, Mr. H. Bessemer, Mr. G. A. Biddell, Mr. H. H. Bigg, Mr. R. W. P. Birch, Mr. H. W. F. Bolckow, M.P., Mr. J. Boyd, Mr. H. Brady, Mr. T. Brassey, M.P., Mr. R. Broad, Capt. E. K. Calvert, R.N., Mr. E. H. Carbutt, Mr. J. A. Carfrae, Mr. A. Carpmael, Mr. J. Church, jun., Lieutenant-Colonel A. Clarke, C.B., Mr. J. Cleghorn, Mr. J. Cochrane, Major W. H. Edgcome, Mr. H. S. Ellis, Mr. J. S. Farmer, Mr. G. Farren, Mr. L. E. Fletcher, Mr. J. Forrest (Secretary), Mr. S. Gedge, Mr. J. Grierson, Mr. D. Halpin, Mr. J. Hancox, Mr. G. Harrison, Mr. J. Hartley, Mr. P. Hedger, Mr. H. A. Hunt, C.B., Mr. T. Jackson, jun., Mr. J. James, Mr. J. Jay, Mr. H. E. Jones, Mr. J. Kelk, Mr. E. Lawrence, Mr. G. Leeman, M.P., Mr. J. Livesey, Mr. J. H. Lloyd, Mr. A. Lucas, Mr. C. T. Lucas, Lieut.-Col. J. G. Medley, Mr. W. W. Moore, Mr. A. Ogilvie, Major W. Palliser, C.B., Mr. A. Penny, Mr. A. Pye-Smith, Mr. F. Ransome, Mr. R. C. Rapier, Mr. T. M. Rickman, Mr. W. Rosser, Mr. A. L. Sacré, Mr. C. P. Sandberg, Mr. J. Shand, Mr. W. Stevens, Mr. G. K. Stothert, Mr. H. Unwin, Mr. R. Vigers, Mr. J. Waddington, Mr. W. T. Walker, and Mr. L. White.

The dinner was provided by Messrs. Ring and Brymer, and Mr. Harker, jun., officiated as toastmaster.

Grace before and after meat was said by the Rev. H. Howarth, B.D., the rector of St. Georges', Hanover-square.

The President proposed the health of the Queen, the Prince of Wales, and the rest of the royal family.

Prince Arthur, on rising to respond, was received with loud cheers. He said: Mr. President, my lords and gentlemen, in the name of the Prince and Princess of Wales and the other members of the royal family, let me thank you for the very kind manner in which you have received this toast. It is a great pleasure to me to be present on this occasion, and to meet so many members of a profession distinguished for its energy, ability, and perseverance, and which, I think I can say, without disparagement to any other country, stands unrivalled in the world. I regret extremely that my brother the Duke of Edinburgh is not here this evening. Few have seen so much of the different parts of the globe as he has done, and he could speak from his own practical experience of the great undertakings and high achievements in different parts of the world connected with the names of the civil engineers of Great Britain. I have not the honour of being a member of this distinguished body, but I am proud to be able to say that I have some affinity with it, as I commenced my career as a soldier in that branch of the army which I hope I may call a sister service—I mean the corps of Royal Engineers.

The President proposed the "Army, the Navy, and the Auxiliary Forces," coupled with the names of Lieutenant-General the hon. Sir James Lindsay, the right hon. the First Lord of the Admiralty, and Lieutenant-Colonel Hawkshaw.

Mr. Goschen said: Last year, when I had the honour of responding to the same toast on behalf of the navy, I had had only a few weeks' experience in connection with the Admiralty; but those few weeks had been enough to show me the intimate connection which existed between the navy and the Institution of Civil Engineers. And since then I have had occasion every week—I might almost say every day—to remark how many questions have the same great interest for the civil engineers as they have for the navy, and *vice versâ*. Every kind of problem connected with engineering science seems to have a bearing on the navy, and, to an extraordinary extent, Vulcan has begun to share with Neptune the empire of the seas. I wish to point out to you the nature of the difficulties now imposed on naval officers by reason of mechanical science having altogether changed the character of our ships and the character of the duties of those officers. I would not deny that the past year has been marked by some naval disasters, and naval officers are a highly sensitive body of men, who deeply feel those disasters; but the public should remember that the problems which have to be solved by naval officers, and the difficulties of their duties, have vastly increased of late. An officer who, in command perhaps of a fine fleet, has been round the world, and after an absence of three or four years returns home a splendid sailor, finds that the construction of the ships has changed, the character of the guns has altered, and the drill has changed; he finds problems of which he knew nothing; he finds the chemists have been at work discovering new properties of metal of which he never heard; and that inventions and discoveries affecting his duties have been made in other directions. I ask for the indulgence of their country towards them in the difficult circumstances in which they are placed. Officers who have been in command of ships who have been round the world, and who have acquired, perhaps, great reputation, are obliged, after being fifteen or twenty years in the service, to go to the college at Portsmouth to study those new problems which, during their absence, it has become necessary to solve, and in this manner to qualify themselves for duties of which they knew nothing when they went abroad. I think it is fair that the country should bear these things in mind, and that, at a meeting of civil engineers especially, it is not inappropriate that I should speak in this way of the difficulties that have been cast upon naval officers—I might almost say upon the whole naval service. The shipwrights have had to go through a similar course; they have had to unlearn their trade as they formerly knew it, and so, also, with the inspectors. With such changes going on, is it surprising that there should sometimes be costly failures and great disasters? Let me say, however, that the naval services will apply themselves with the assiduity and energy that distinguish them to master those new problems and acquire the fresh knowledge which is necessary. We hope, by the establishment of a great new educational college at Greenwich, to stimulate that which already exists—namely, the intense desire of naval officers to become equal to the great difficulties and responsibilities that devolve upon them. By these difficulties the naval service will not be discouraged, and I must ask the country not to lose confidence in them.

Lieutenant-Colonel Hawkshaw, returned thanks for the Auxiliary Forces.

The President next proposed the toast of "Her Majesty's Ministers," coupled with the name of the hon. the First Lord of the Treasury.

Mr. Gladstone, who was cordially cheered upon rising, responded. After the customary expressions of thanks for the compliment, the right hon. gentleman said—We accept this toast as the tribute of respect which you pay to the constituted authorities by which the framework of society is kept in order; and if that is done in some degree by the agency of these constituted authorities, perhaps it may be admitted that their business gives adequate employment to those who are concerned in the administration, without that perpetual intermeddling which had been the distinction and perhaps the curse of some other countries. Nothing could be more satisfactory for us than to feel, as the president has said, that the Institution has received from the present Government the respect that is its due, because I feel that if you have received from us all the respect that you deserve it has been very great indeed. The president has told us that the duties of the Government in this country have been chiefly negative duties. For my part, sir, I trust that they will always so continue. In the days of my youth that was so, beyond dispute. The great statesman under whose shadow I passed my political youth held the doctrine of general non-interference as an article of faith, without distinction of political party. In my mature—and I am afraid I must in candour say declining—years—at any rate, after more years than I am willing to count, or should like to state, I see a change creeping over the habit of mind of the people of this country with respect to the interference of the Government, and to the committing to its direct parentage and tutelage many of the pursuits of the people. That tendency may be, and I think is in a certain degree the results of the social necessities of the time; but I do not hesitate to say that it requires to be watched with jealousy. It is in the growth of national and local energies—it is in the free development of private spirit—it is in the moulding of every pursuit according to its true direction and to its legitimate and natural exigencies, freed from all artificial and extraneous interference, that the real greatness of a country lies. You are the youngest of the professions; but after having crept along in the weakness of infancy your profession has in our time arrived at a gigantic and astounding development, and you differ from all possible political ministries in this respect—that the benefit of your performances is universally acknowledged. The right hon. gentleman concluded by expressing in a few eloquent terms his confidence that the labours of the civil engineers, in the future as in the past, would deserve and would receive the gratitude of mankind. Some other toasts followed before the company separated.

The general arrangements of the dinner, under the charge of Mr. Forrest, gave great satisfaction.

The President, in proposing "The Houses of Lords and Commons," regretted the tendency that prevailed to remove from the Legislature the jurisdiction they had exercised to the benefit not only of the profession, but of the public. Speaking after forty years' experience, he doubted whether any tribunal could be substituted with equal advantage to the country. The committees on private bills were an admirable school for members, and if they were taken away Parliament would become a mere political club.

Lord Redesdale, in replying, on behalf of the House of Lords, doubted whether any but a parliamentary tribunal could deal satisfactorily with the great works that were now submitted for their jurisdiction.

Mr. Monsell acknowledged the toast on behalf of the House of Commons.

The other toasts were "Prosperity to the Institution of Civil Engineers," proposed by Mr. Baron Bramwell, and acknowledged by the President; "Our Visitors" coupled with the name of the Earl of Devon, and lastly "The Learned Societies," proposed by Sir W. Armstrong, C.B., and acknowledged by Dr. Joule.

The arrangements were under the direction of Mr. James Forrest, the secretary of the Institution.