The harp in its present improved state compared with the original pedal harp

1 First 6 weeks ..
2 Bochsa, Daily precepts. Course
3 Elegant Extracts.

4 The Harp Preludist.

5 Explanatory Appendage to the
Harp Preludist.

6 Elementos de Musica e Methodo de tocar
Piano forte por Bomtempo

7 Latours Instruction for the Piano forte

8 Practical Thorough bass.

THE HARP

IN ITS PRESENT IMPROVED STATE,

COMPARED WITH

THE ORIGINAL PEDAL HARP.

The first Pedal Harps exhibited in England, about forty years ago, were imported from France, and are known at the present time under the denomination of *French Harps*. The plan of their mechanism, and the proportions upon which the tone is dependent, are generally allowed to be defective in many essential points.

A great defect in the construction of these harps is, that the action of the pedal, to give the string a second sound, draws it out of the vertical perpendicular, to make it rest upon the neck of the instrument at A, (see Pl. I. Fig. I.); which lateral motion greatly increases the difficulty of the execution, by depraving the uniformity of the distances between the strings; and tends to put the string out of tune, by making it deviate from its original position, as the curve which it so describes makes it much longer than the straight line from the sounding-board, to the fixed stud or bridge. Besides, the system of cranks and rods, at A, A, A, A, which actuate the motion, is constructed upon so wrong

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Fig. 1.

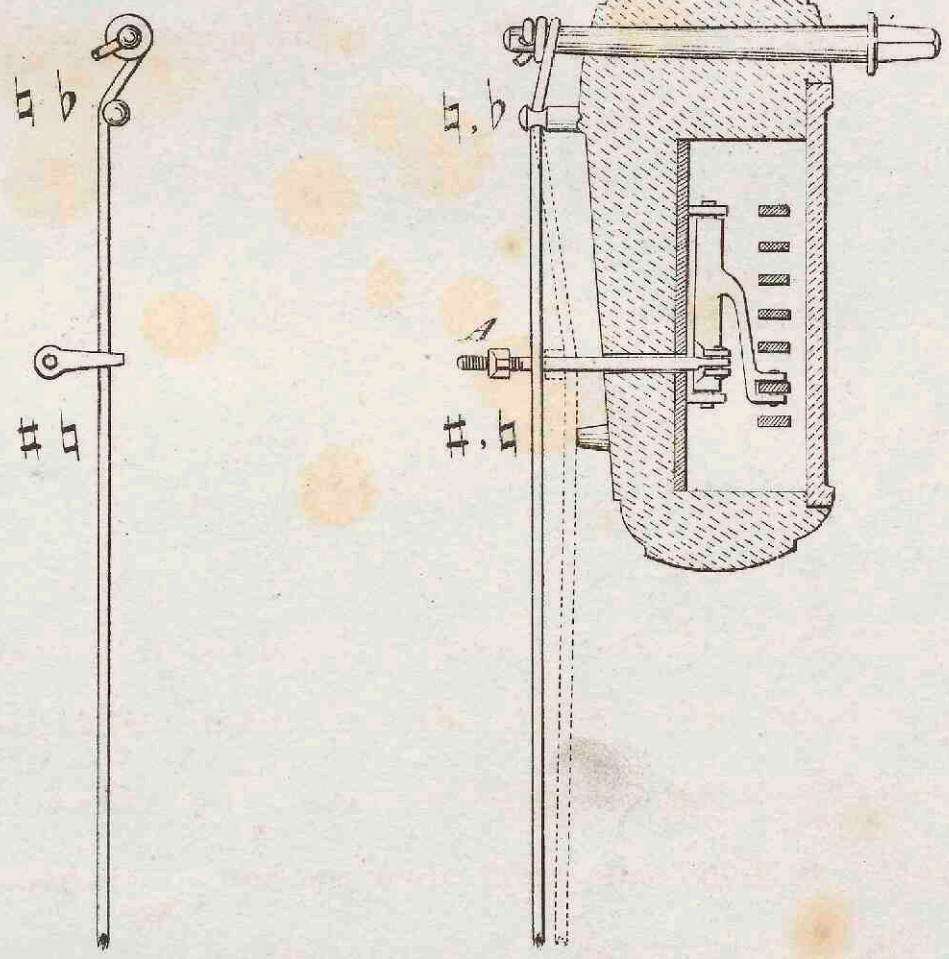
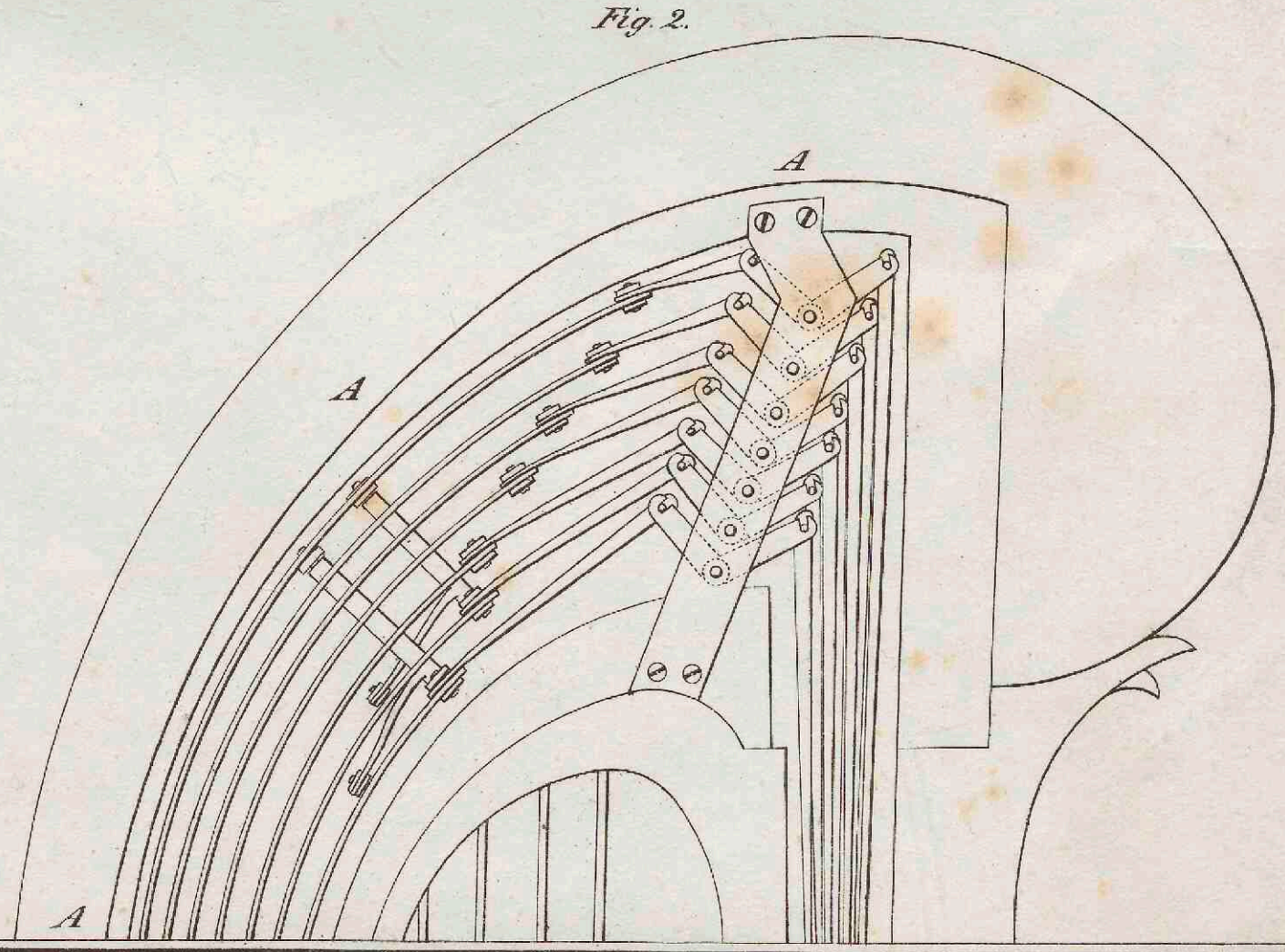


Fig. 2.



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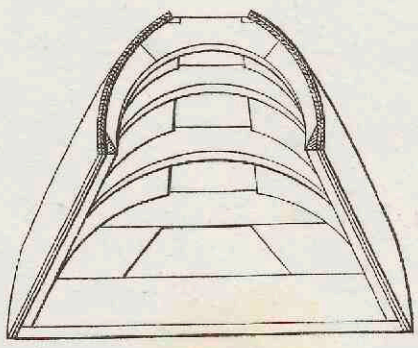
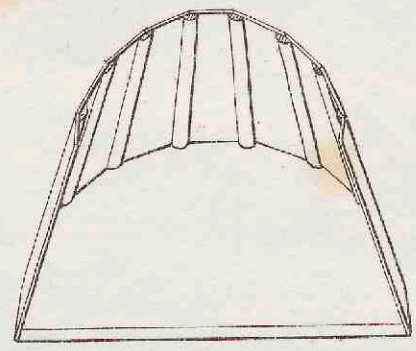


Fig. 2.



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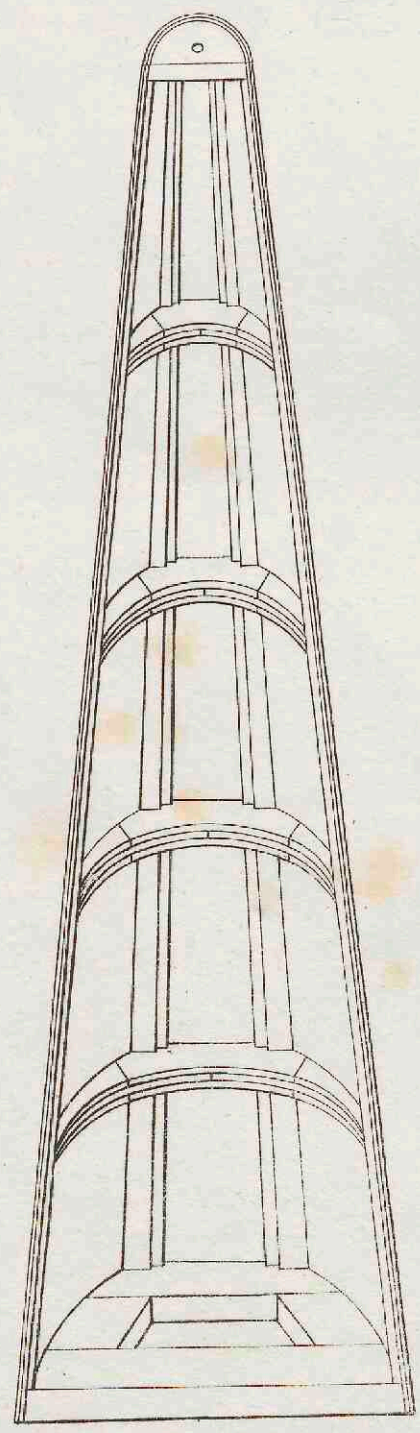

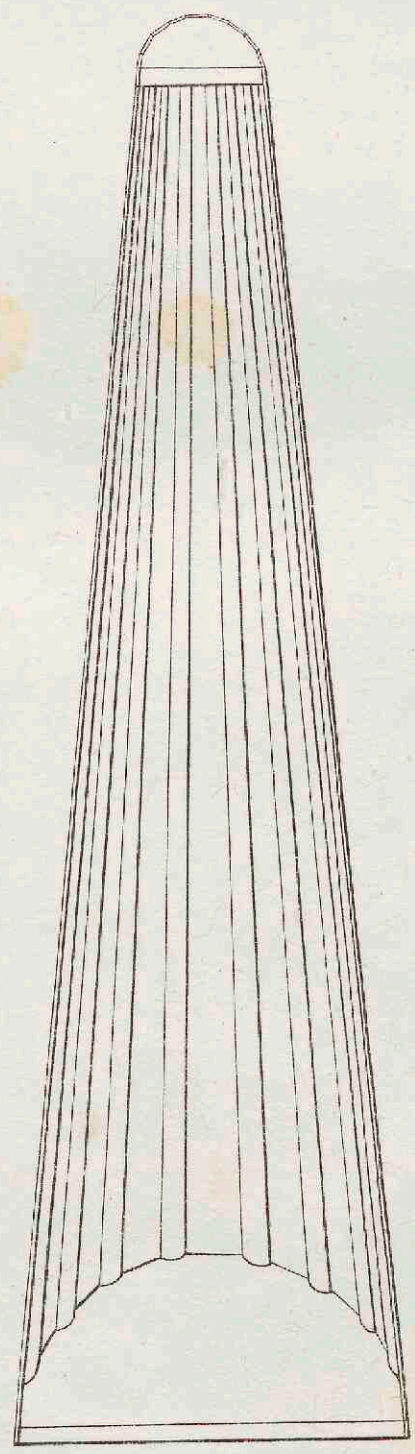

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a principle, *(see Pl. I. Fig. 2. and Pl. II. Fig. 1.)* that it cannot be depended upon to stop the string, when shortened the degree of a semitone, with sufficient tightness to produce as clear and pure a tone as when open.

These are defects dependent upon the mechanism. There are others attending the construction of the frame or wood-work of the harp, of no less importance.

The mechanism being introduced into the neck, hollowed out to receive the same, *(see Pl. I. Fig. 1, 2.)* the necessary curve to preserve the due proportions of the strings throughout the instrument could not be given to the neck, without great danger of its giving way; and as that part of the instrument was originally shaped out of one solid piece, the grain of the wood must have been cut in the bent part of it, and rendered the more liable to break.

With such defects in the construction of the neck of the harp, it would have been impossible ever to string the instrument with strings of the size now in general use, the weight or draught being, thus, more than doubly increased.

The sonorous body used to be made out of seven or nine pieces: which construction was attended with considerable trouble to the workman, and was never to be depended upon in point of solidity. *(See Pl. III. Fig. 1.)*

Such was the state of the harp, as imported from the Continent, when Mr. Sebastian Erard took out his first patent in 1794, *the first for the harp ever granted in England:* and a slight inspection of this harp will make it evident, that he effected a complete revolution in the system of construction for that instrument. *(See Pl. IV. Fig.* 1.) Instead of enclosing the mechanism in the wood itself, he makes it quite independent of the frame or wood-work: the system of cranks and rods, *a, a, a, a, (see Pl. II. Fig.* 2.) acting upon each other in a direct and uniform manner, is placed under the wooden part of the neck *b, b, b,* at A, *(see Pl. IV. Fig.* 1.) and made to act between two brass plates *c, c, c, c,* which serve as true and immoveable bearings *d, d,* for the different centres of the mechanism. Those two brass plates, which contain the whole of the mechanism, are placed upon the neck of the harp when put together, and have the property of giving it additional strength.

Mr. Sebastian Erard was the first to construct the neck of several pieces of wood, so as to make the grain run in straight lines, wedging each other in the bent parts.

The most ingenious and useful of his first improvements is the mechanical contrivance, generally known by the name of the *fork. (See Pl. IV. Fig.* 1 *and* 2.) It is so universally acknowledged to be superior to any other means known or employed for the purpose of shortening the string, to give it another tone, that all the harp-makers in the United Kingdom avail themselves of the invention.

Fig. 1.

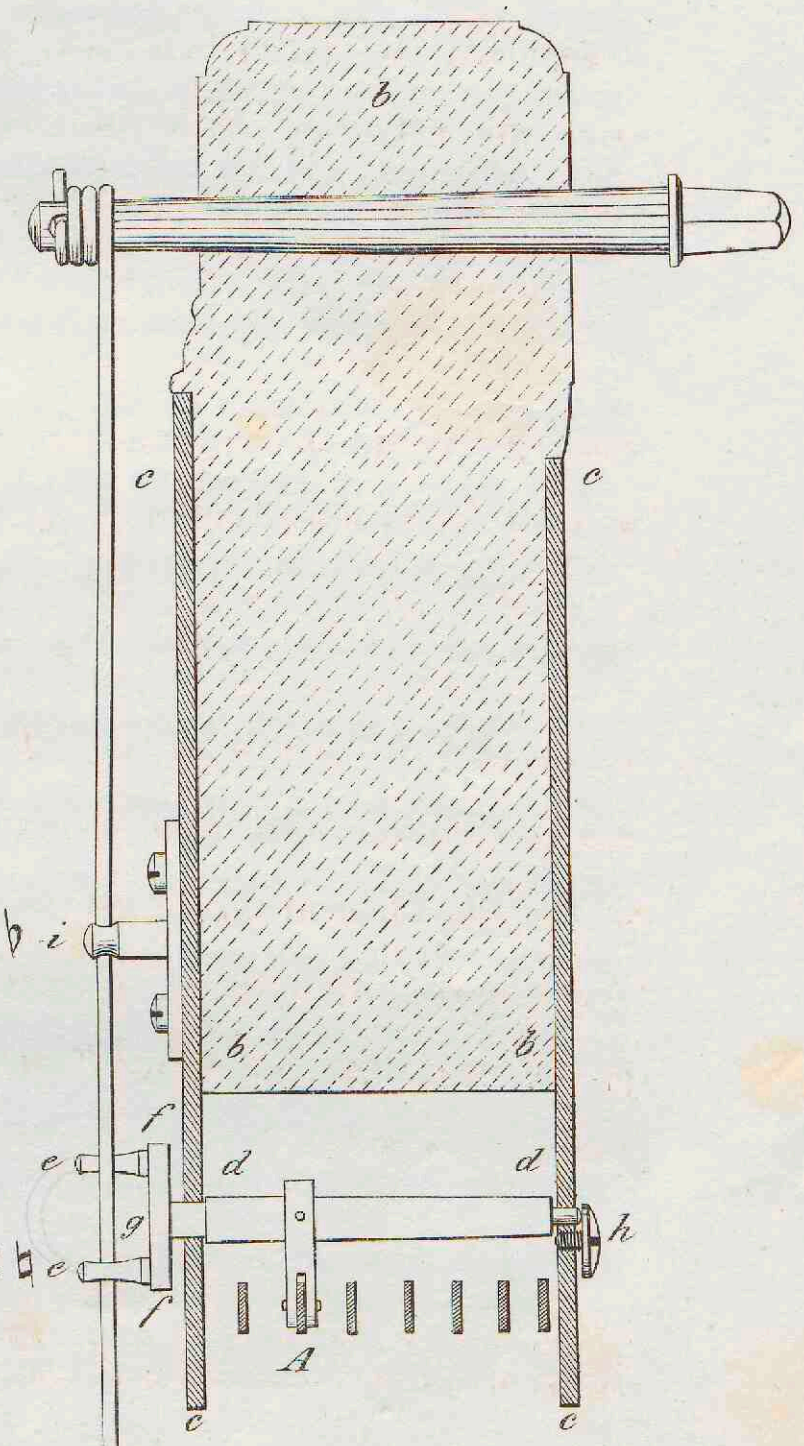
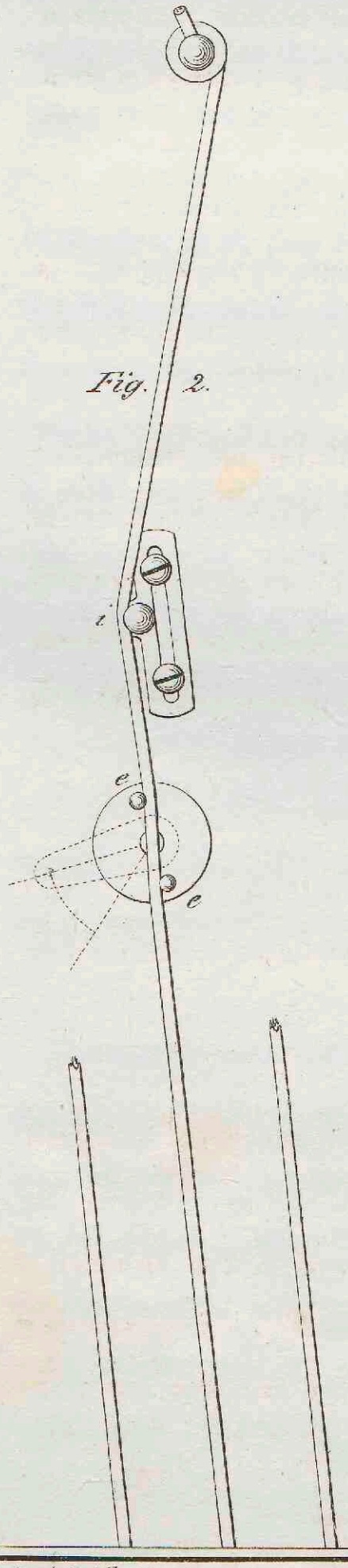


Fig. 2.



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The great merit of any mechanism rests on its simplicity: the fork is merely two prongs or points *e*, *e*, mounted upon a little brass round plate or disk *f*, *f*, the centre of which is screwed upon an axis or arbor *g*, *h*, passing through the two plates *c*, *c*, *c*, *c*, (*see Pl. IV. Fig.* 1, 2.) The string pends from the bridge pin or stud *i*, so as to cross the face of the round part or disk; when the pedal is depressed, the levers and connecting rods *a*, *a*, *a*, *a*, (*see Pl. II. Fig.* 2.) placed under the wooden part of the neck at *A*, (*see Pl. IV. Fig.* 1.) act on the axis *g*, *h*, upon which the fork is mounted, so as to make it describe a sufficient angular motion to bring the two pins *e*, *e*, on the disk, into contact with the string, thus shortening it the degree of a semitone, and at the same time pressing it with sufficient tightness to make the string produce as clear and as firm a tone as when open. *The string, however, is kept perfectly parallel to the two contiguous strings, and free from any lateral motion in the vertical plane.* (*See Pl. IV. Fig.* 1, 2.)

Twenty-five years' experience, a stronger argument than the best reasoning, has proved, that the proper pressure of the fork does not overpower the natural elasticity of the string.

There are several other improvements in Mr. Sebastian Erard's harp, which, though not so essentially important, yet contributed to render his work perfect: such as the adjusting screw *h*, at the back plate (*see Pl. IV. Fig.* 1.); the different ways of connecting the different parts of the mechanism; and the round shape which he gave to the sonorous body, rendering it by so doing much more sonorous and more durable. (*See Pl. III. Fig.* 2.)

The proportions of the strings were also greatly altered by him, so that the French harp and Sebastian Erard's compared might be said to have that striking difference between each other, in point of tone, which exists between a grand Piano Forte and a Harpsichord; and, in point of construction, that which exists between the badly-constructed old wooden machinery mills, and one of our present improved cast-iron engines.

The consequence of those very striking improvements in the harp was, that it rose considerably in the estimation of the musical world. The professors and amateurs of the greatest merit, both in this country and abroad, were eager to procure Erard's harps, and thus they shortly got into general use.

Mr. Sebastian Erard soon effected further improvements upon his first harp; the pedal, for instance, which used to consist of two levers, acting upon one another, and the one which projects out of the pedestal being made with a joint to allow its lateral motion into the notch, (*see Pl. V. Fig.* 1.) he greatly simplified in making it into one single lever, or arm. (*See Pl. V. Fig.* 2.)

Thus, about the year 1800, the single action harp had attained so satisfactory a state of perfection as to admit of no further improvement in its mechanical construction; it was still however very defective as to its powers of modulation:—from the very nature of the

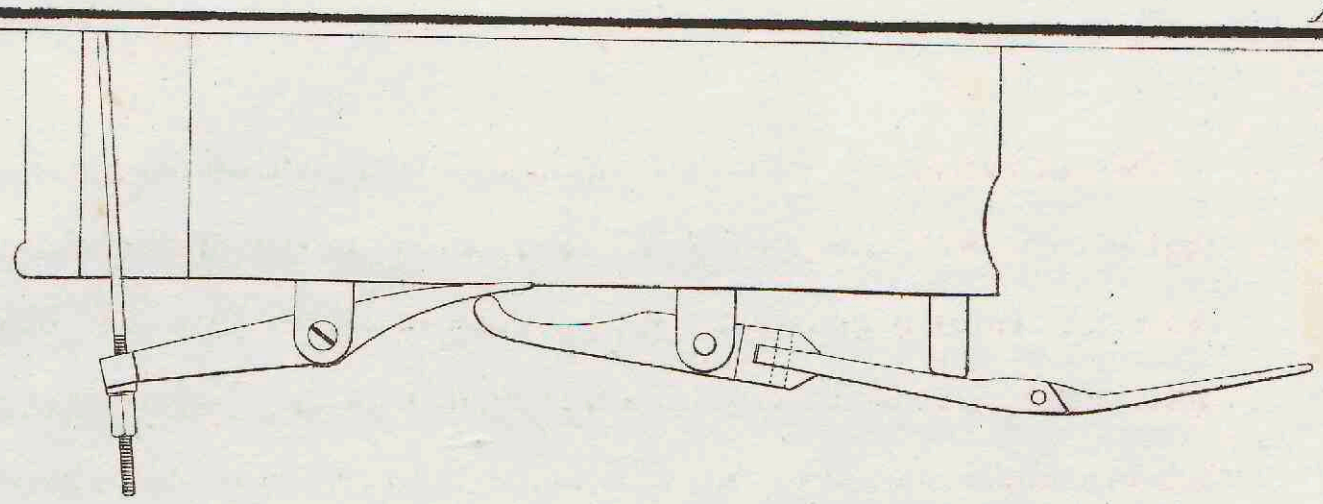
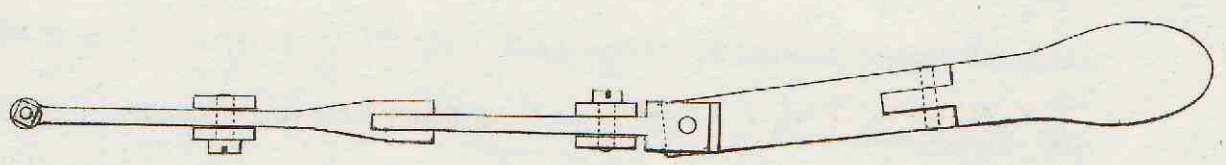


Fig. 1.



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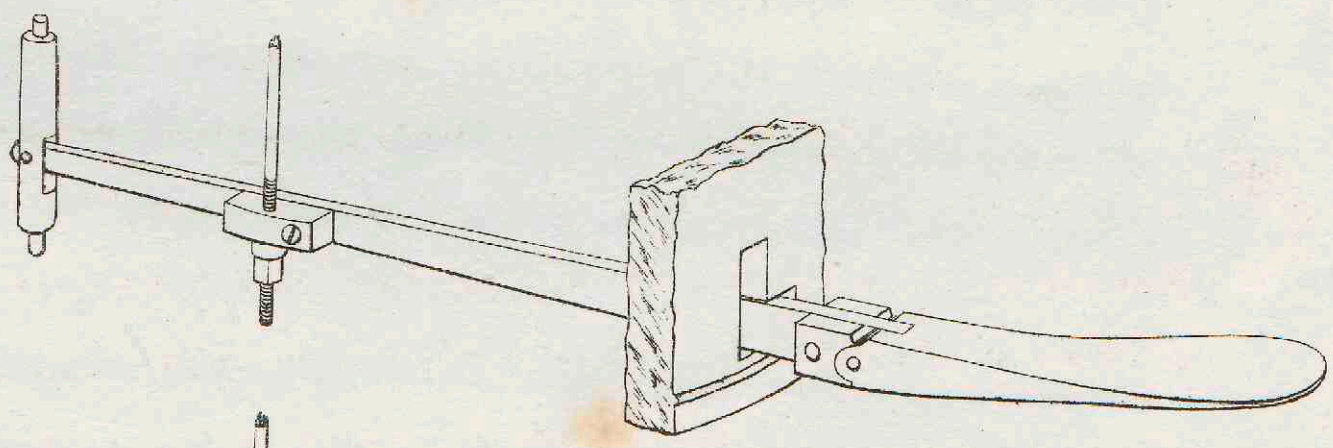
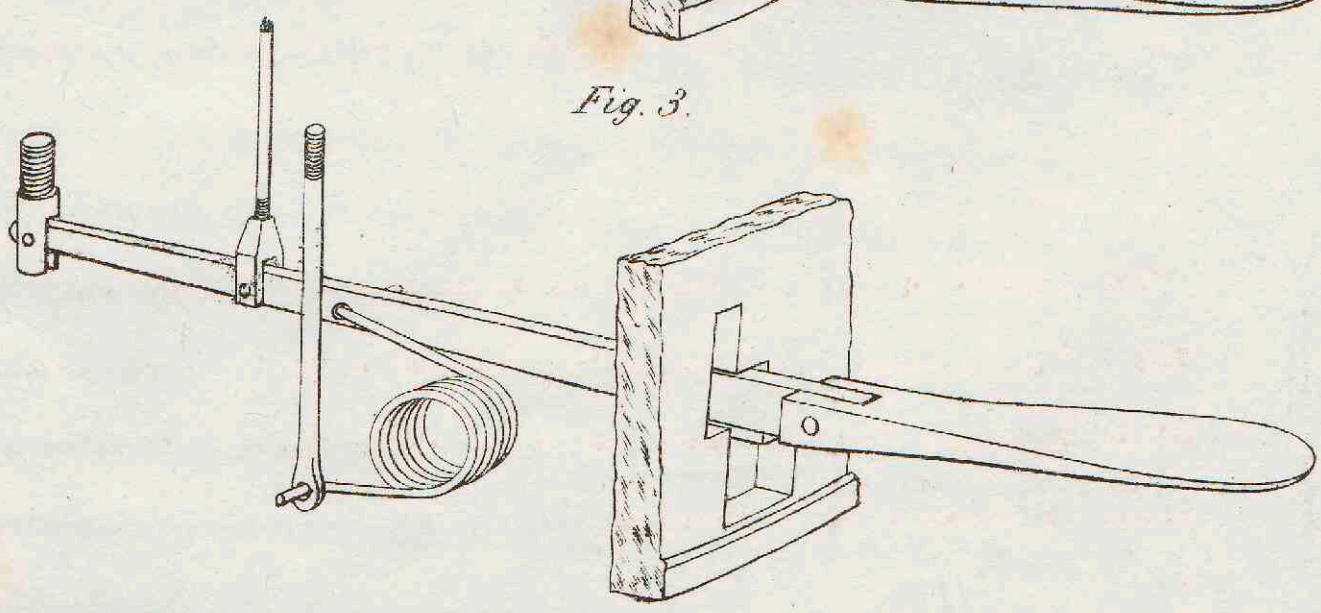


Fig. 3.



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instrument, since sufficient room must be left for the fingers to have free access between the strings, it is not practicable to have more than seven strings within the octave, which number, with the requisite distance between them, forms as wide a space as the hand, placed in a proper position upon the instrument, can reach with facility.

Those seven strings are generally tuned diatonically upon the single action harp in the key of E 3 flats; that mode of tuning seems to have been generally adopted as the best to divide, as much as possible, the imperfection of the instrument, between the flats and the sharps. The action of each pedal raising each string one semitone, upon the single action harp, had it been tuned in the key of C the modulations practicable would have been confined to keys with sharps, whilst, by tuning the harp in a key with flats, the number of keys practicable is divided between the flats and the sharps, though not increased, for where the advantage of the flat is gained, that of the sharp is lost, and *vice versa.*

This imperfection of the instrument as to modulation could not escape the observing mind of Mr. Sebastian Erard; he made the first attempt to remedy it about the year 1801, when he completed a harp which produced *three distinct sounds upon every string*, viz. *the flat, the natural, and the sharp.*

The patent for that harp is dated the 16th of June, 1801. It contains the double notch, or cut, in the pedestal of the harp, by means of which the pedal, after having been pressed to a first rest, as in the single

action harp, may be pressed to a second rest, (*see Pl. VI. Fig.* 4.) This contrivance is an essential part of the construction of a double action harp, and those who now attempt to make double movement harps, avail themselves of it as well as of all his other improvements, *and perhaps some of them without knowing who was the original inventor.*

The principle of the mechanism to effect the semitones, is different from that of his single action harp, produced in 1794, namely, *the shortening the strings by means of a fork.*

The pedal when depressed makes the rest pin *a*, (*see Pl. VI. Fig.* 1, 2, 3.) upon which the string is wound, turn round, and describe a certain angular motion, which winds up the string so as to raise it two successive semitones, in the same way that it might be done with a tuning hammer. As the outward appearance of the mechanism was the same, whether the string were flat, natural, or sharp, Mr. Sebastian Erard contrived at the time a sort of index, to shew the position of the pedal :—it consisted of a needle attached to the rest pin itself, and which by following the rotatory motion of the rest pin, pointed to the figure flat, natural, or sharp, (*see Pl. VI. Fig.* 1, 2, 3.)

This mode of effecting the semitones upon the harp had some advantages, but was attended on the other hand with inconvenience, that of encreasing the tension of the string. There are those, perhaps, who would have produced this harp to the public, and promoted its sale; but Mr. Sebastian Erard was aware of the defects of an instrument built upon such a plan, and knew that it could never be of general use, he therefore,

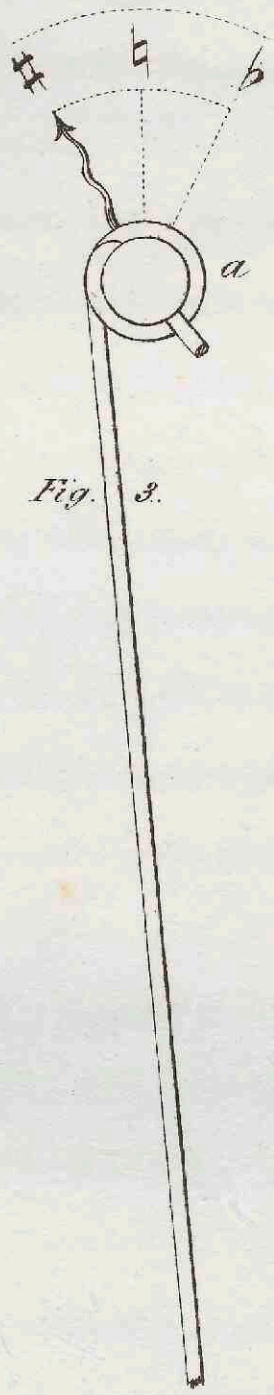


Fig. 3.

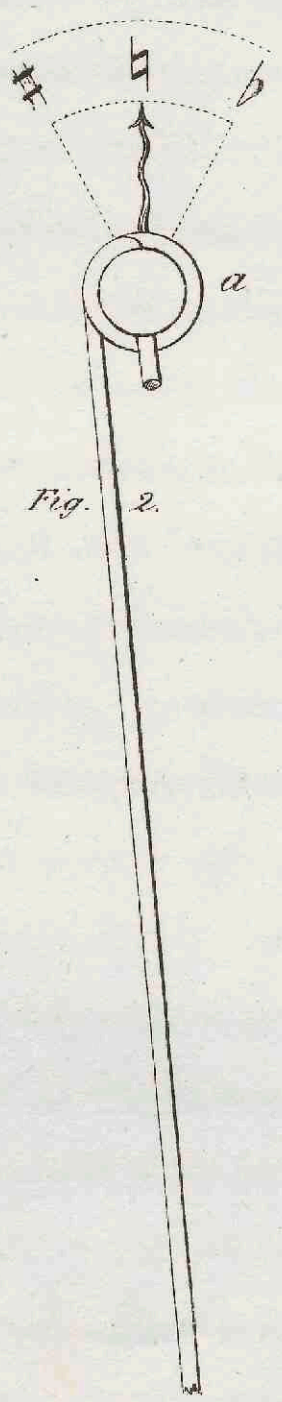
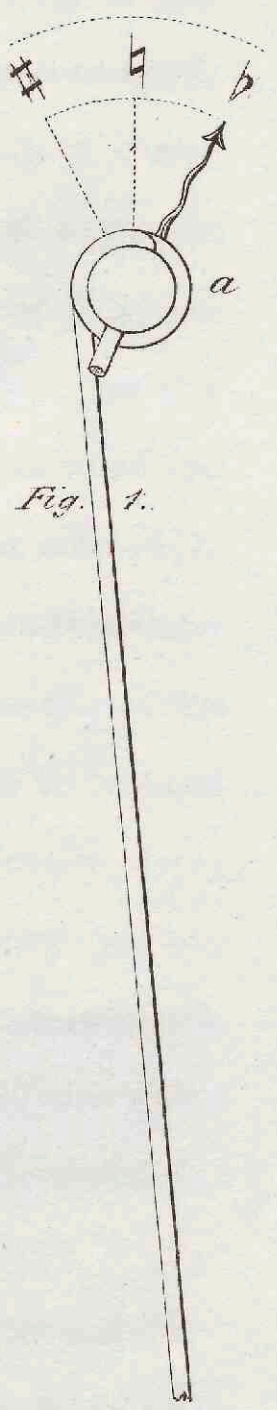


Fig. 2.



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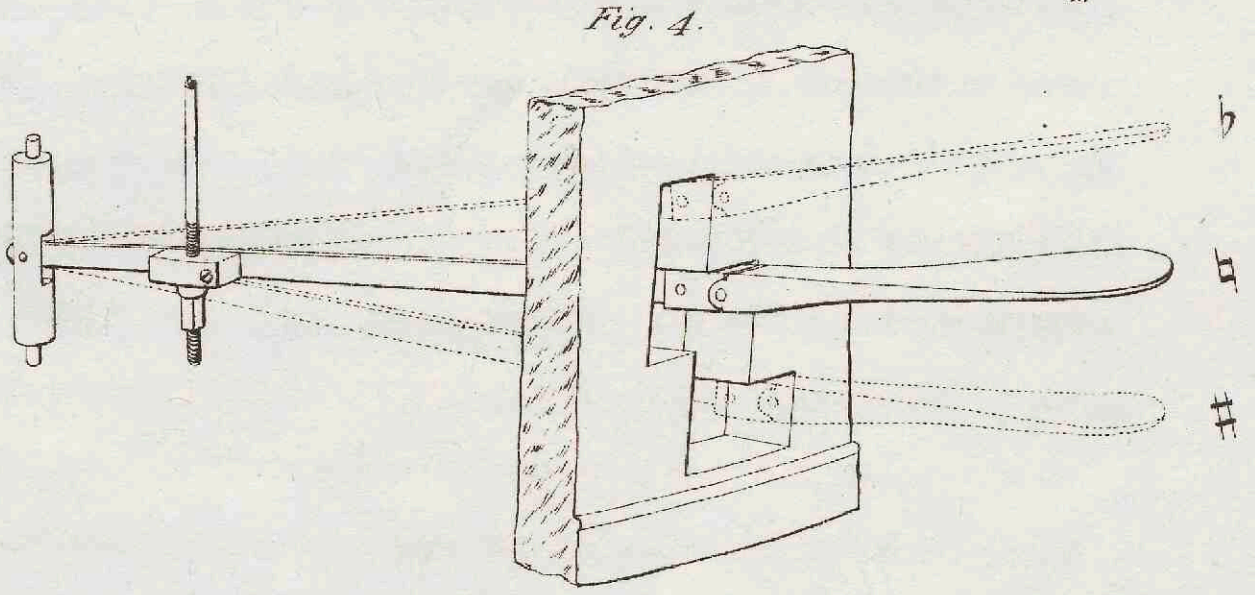

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regardless of the great expence and labor he had incurred, reserved it as a mere curiosity. Its mechanism is well worth the attention of the curious, as it contains several problems in mechanics, difficult to solve.

It was about the year 1808 that Mr. Sebastian Erard began his double action harp upon the same principle as that of his single action harp, produced in 1794, namely, *the shortening the string by means of a fork.* He then pursued a series of laborious experiments, all of which are contained in his patents of 1808, and 1810; and it was not until 1811, after having spent no less than twenty thousand pounds in establishing in his manufactory the different machines upon which the nicety of the execution of a mechanical work so essentially depends, that he brought out his present double action harp.

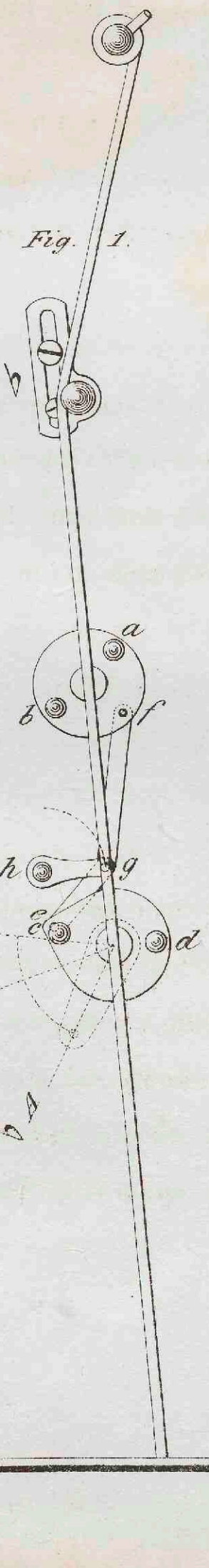
In this he preserved exactly the same simplicity of mechanism as in his single action, and he accomplished the shortening each string two successive semitones by means of one pedal, in the following manner:

The reciprocating motion is conveniently encreased, and divided into two parts from A to B, and B to C, (*See Pl. II. Fig.* 3. *and Pl. VII. Fig.* 1.) This motion is communicated to the axis or arbor upon which the lower fork effecting the sharp is mounted; the position of the two forks, when the string is open or flat, is such, (*see Pl. VII. Fig.* 1.) that whilst a line drawn between the two points *a*, *b*, upon

the upper disk, would cut the string at acute angles, a line drawn between the two points *c*, *d*, upon the lower disk, would cut the string at right angles, or nearly so. The upper and the lower forks are connected to each other by three small pieces, two of which are small steel links attached by joints *e*, *f*, at one end, to the extremities of the forks, at requisite points, and at the other ends, both to the extremity g, of a small brass lever moving round a fixed stud, screwed fast into the brass plate at *h*.

The relations and proportions which these different pieces bear to each other are such, that by depressing the pedal to the first rest, the first part of the motion from A to B being actuated upon the centre or axis of the lower fork, the upper link *f*, *g*, attached to the upper fork, and the little brass lever *g*, *h*, turning round its own centre at *h*, are moved by the assistance of the other link *g*, *e*, attached to the lower fork, so as to form a straight line, *f*, *g*, *h*, (*see Pl. VII. Fig.* 2.) By this operation the upper fork has been made to press the string firmly at *a*, *b*, (*see Pl. VII. Fig.* 2.) to shorten it the first semitone, and vibrating freely between the two prongs on the lower disk, the string sounds the natural. From the circumstance of the upper link *f*, *g*, and the brass lever *g*, *h*, forming one straight line, it follows, that all the weight occasioned by the pressure of the upper fork upon the string at *a*, (*see Pl. VII. Fig.* 2.) rests entirely upon the fixed stud of the brass lever screwed fast into the plate at *h*, and is thus rendered perfectly independent of the actuating or main motion upon the axis of

Fig. 1.



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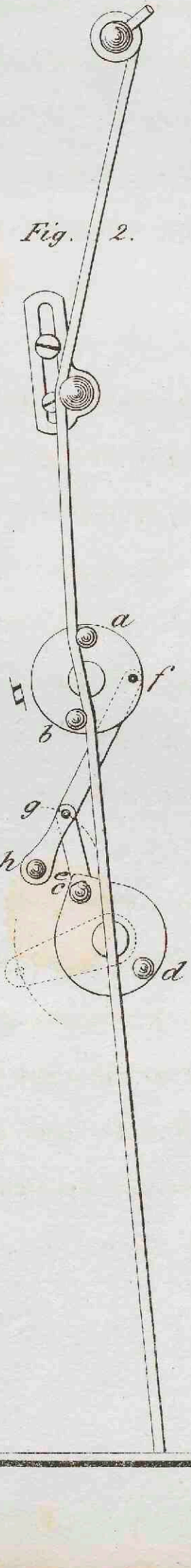

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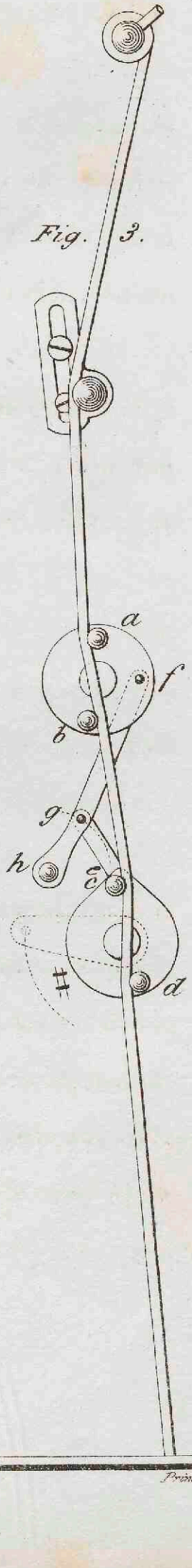

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the lower fork. For the second shortening of the string, or for the sharp tone, the second part of the motion from B to C is gone through by depressing the pedal a second time, and the lower fork presses the string at *c*, *d*, *(see Pl. VII. Fig.* 3.) exactly in the same way that it does in the single action harp.

To produce the above effect from one actuating pivot or centre only, so as to render the second part of the motion perfectly free from the weight occasioned by the pressure of the upper fork, Mr. Sebastian Erard had to solve one of those delicate problems called in mechanics *escapements*, which in his mechanism is thus effected: the weight of the pressure of the upper fork rests, as we have just described, upon the centre of the brass lever screwed fast into the plate at *h*, *(see Pl. VII. Fig.* 2.) and is quite independent of the actuating motion upon the lower arbor; but the straight line formed by the upper link *f*, *g*, and the brass lever *g*, *h*, being broken into two pieces at *g*, allows the lower link *e*, *g*, and the lower disk, to pass over the centre without any obstruction.

By successively unfixing the pedal from the two notches, the same effects are produced in an inverted manner with equal facility; and, considering that the combination of the different movements belonging to one pedal is actuated merely by the sinking and rising of one rod enclosed within the pillar, it will be perceived with what nicety the movements are combined.

Any person taking the trouble of examining the movement above described, and selected by Mr. Sebastian Erard as the best, from several others of his own invention, must allow that it unites the utmost simplicity with the most perfect efficacy. Five pieces only, two of which are the disks with prongs on them to shorten the string, effect the operation, and the motion is distributed to the different pieces from one axis only, that of the lower fork.

These movements, which are on the outside of the plate, and contrived for each separate string in the bass, as at *h*, *i*, *k*, *(see Pl. VIII.)* disappear about the middle of the harp, at *l*, *m*, where the weight of the strings diminishes in proportion to their diminished length and thickness. A similar motion to that on the outside, is then contrived inside of the mechanism, once for each string of a different name, and is afterwards communicated by connecting rods from octave to octave, upon both the upper and lower rows of forks.

Mr. Sebastian Erard might easily have adopted this plan of construction throughout the whole compass of the instrument, by merely contriving the movement once for the seven different strings in the octave, at the head of the harp, communicating the same by rods from octave to octave up to the top; and this arrangement would at first sight appear more simple, as there would be nothing on the outside of the brass plate, but the two forks to each string, as at *l*, *m*, *(see Pl. VIII.)* He, however, rejected it as very defective.

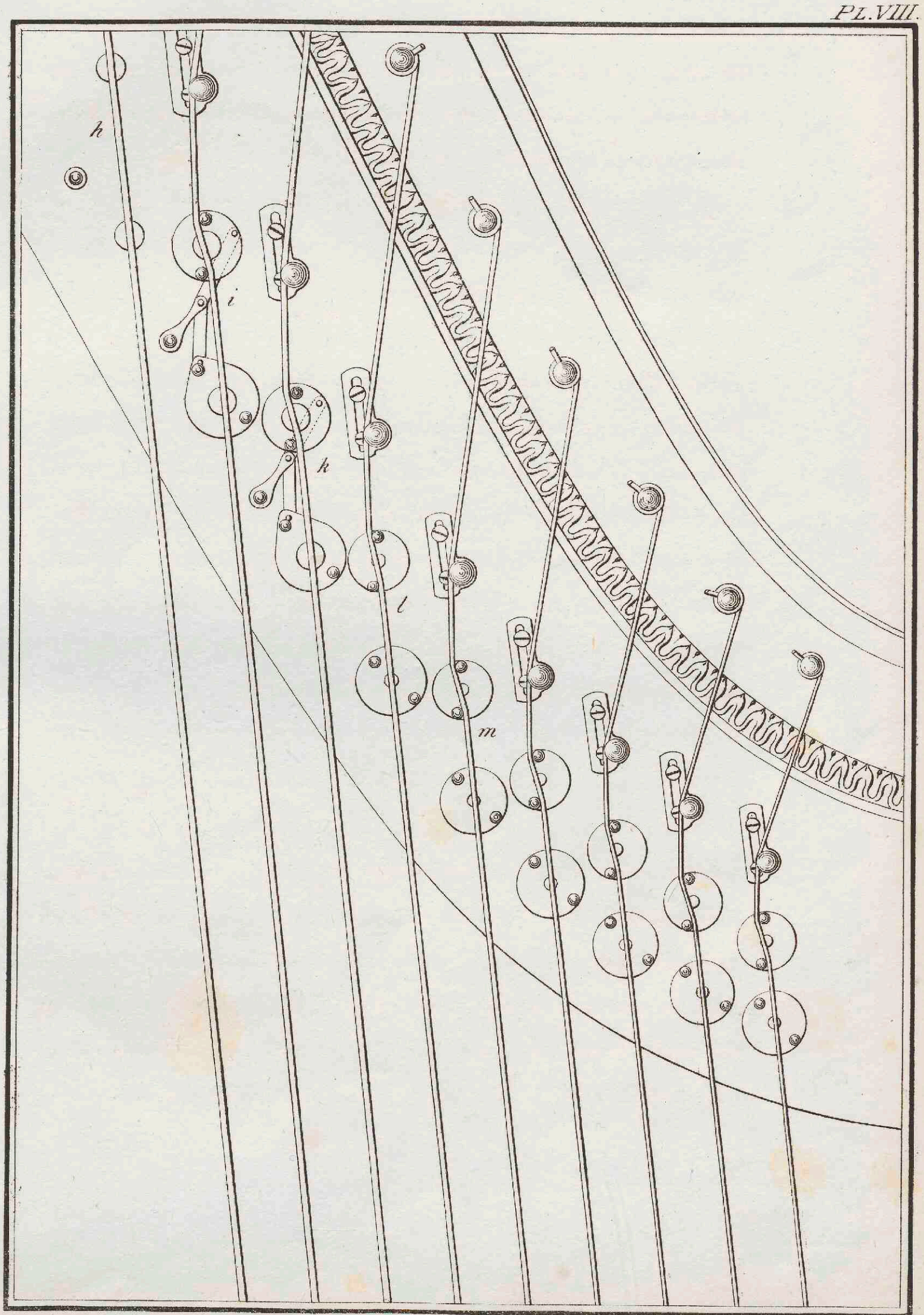

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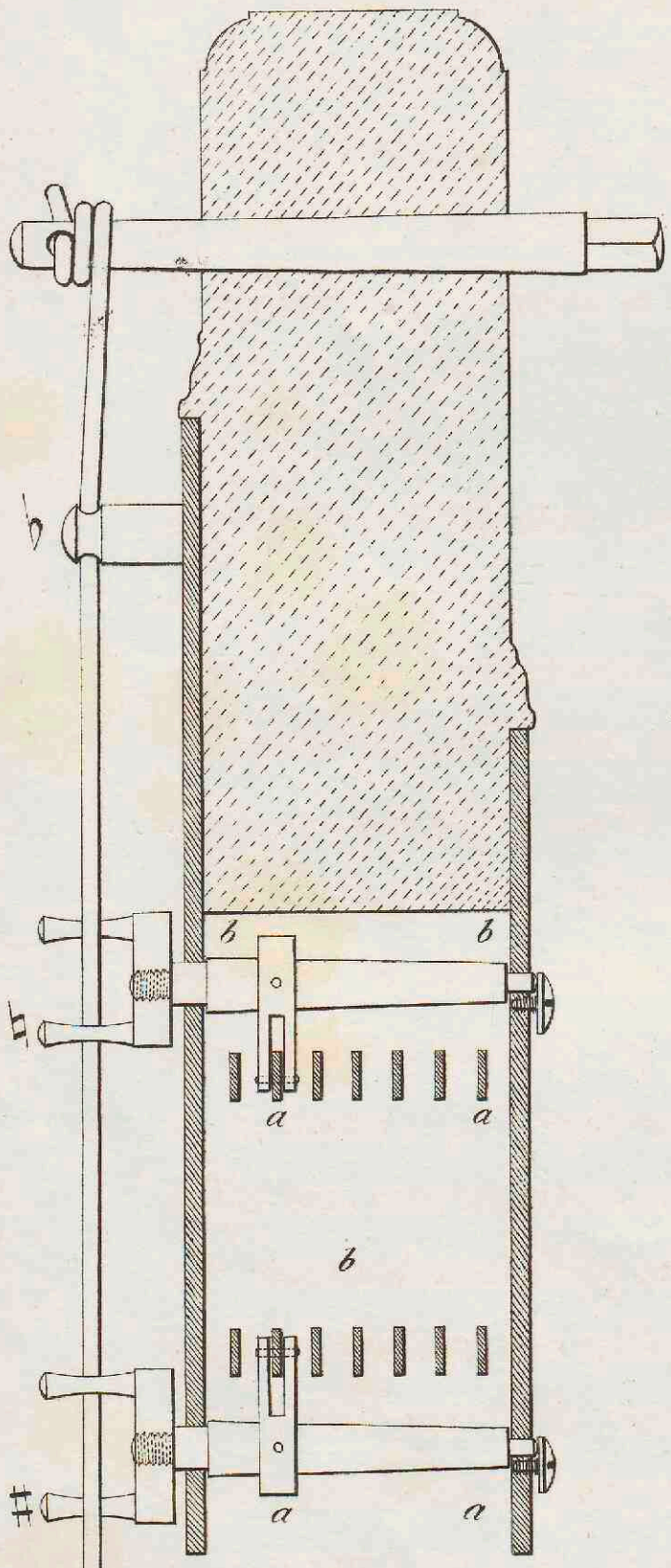
Fig. 1.



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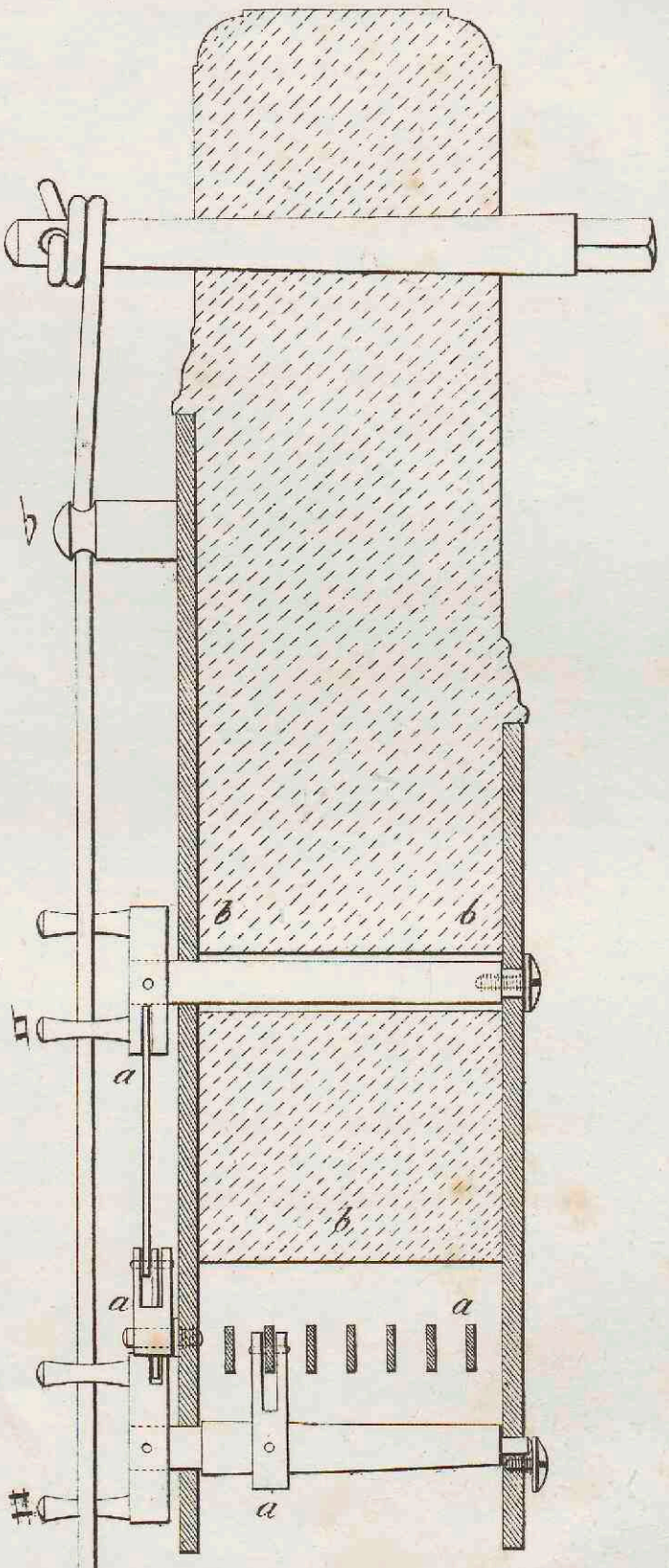

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In fact, to allow sufficient room within the neck of the harp for the action of two ranges of movements, one above the other, as at *a*, *a*, *a*, *a*, (*see Pl. IX. Fig.* 1.) instead of having the movements outside, as at *a*, *a*, *a*, *a*, (*see Pl. IX. Fig.* 2.) the neck must be considerably weakened by cutting away about one third of the wood, as at *b*, *b*, *b*, (*see Pl. IX. Fig.* 1, 2.) whilst that part of the instrument cannot be made too strong, in the bass especially, to resist the great weight or draught of the strings.

From the natural structure of the harp, (where the two parts upon which the strings are fastened at both ends, viz. the neck, and the sonorous body, cannot be kept apart from each other by any other support but the pillar, as free access to the strings must be left for the hands on both sides of the vertical plane formed by the range of strings,) it follows, that when the neck or curved part where the mechanism lies, is not made sufficiently strong to resist the tension of the strings, when drawn up to concert pitch, it will get distorted and alter completely its shape, from that in the original plan of the instrument; the mechanism in that case must evidently get deranged also, and answer no longer with the precision required to effect the semitones. Besides, Mr. Sebastian Erard, in contriving the movements outside and separately to each string in the bass, divides, upon *three* and *four* different studs, as at *h*, (*see Pl. VII. Fig.* 2.) the weight of the pressure of the forks effecting the naturals, upon six strings in the whole compass of the instrument, instead of having the whole weight rest upon only *one* movement at the head of the harp, which evidently

renders his mechanism as many times less liable to get out of order, or to wear out by use.

The tone, which so essentially depends upon the firmness with which the string is stopped, could not be so good where the steadiness of twelve forks, six for the naturals, and six for the sharps, pressing upon six strings of the same name, should depend upon one combination of movements at the head of the harp, instead of resting upon three, four, or five, in different parts of the neck, as in the mode of construction adopted by Mr. Sebastian Erard.

In short, this mode of construction of having the movements outside on the brass plate, and contrived separately for each separate string in the bass, is the only one which can be employed with success, as it is the only one which combines the requisite advantages of precision and solidity.

Mr. Sebastian Erard improved the pedal in his double action harp still further; the centre of action is contrived by means of a screw turning into a brass socket, affording an easy lateral motion, (*see Pl. V. Fig.* 3.) This lateral motion is rendered true and steady by his new spring, which, being placed on the side of the pedal, makes it go of itself into the notch, when depressed by the foot, and keeps it in that position with sufficient steadiness to prevent its slipping off again (*see Pl. V. Fig.* 3.); and in case of that spring breaking, in the country, or in a distant climate, another may be introduced with the greatest facility, whilst

in harps where the springs are placed within the mechanism itself, the instrument must be taken entirely to pieces to be repaired.

The double action harp has very great advantages over the single, in point of musical theory; but, as the object in view was to consider the harp simply as a mechanical production, it will be sufficient to state that, instead of thirteen scales, (eight major and five minor,) practicable upon the single action harp, the double action possesses *twenty-seven complete, (fifteen major and twelve minor,)* with the advantage of an uniform fingering for all of them.

The double action harp is, of all instruments with fixed sounds, the most perfect; and as it possesses *twenty one sounds* in the octave, instead of *twelve* as keyed instruments, it is susceptible of a much more perfect system of temperament.

The plate at the end has been annexed to give a view of the general plan of the instrument, in regard to musical theory.

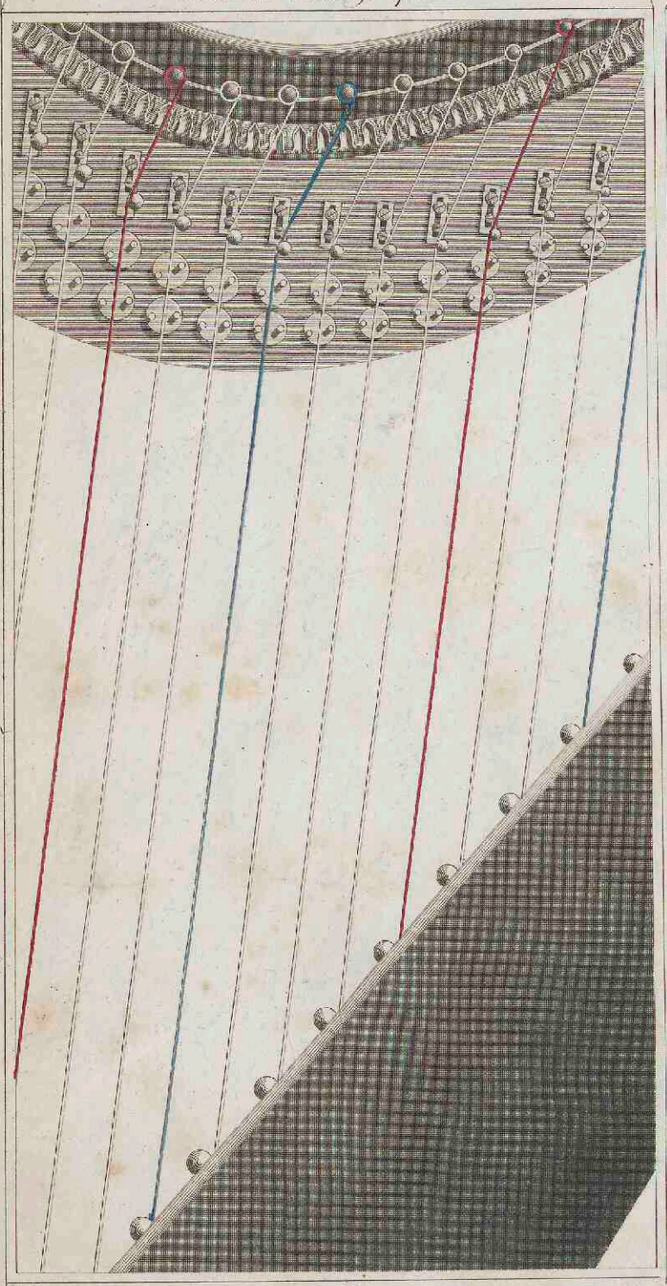
It would be superfluous to pass any encomium on Mr. Sebastian Erard's harps—they speak for themselves, and have proved on trial to answer in any climate; his double action harp must ever stand as an attesting proof of the merit of the man to whom the public are indebted for that invention.

The Double Movement Harp!

Invented by Sebastian Erard.

Fig. ♭ 1.

All the Strings open.



All the Pedals up.

C♭

Fig. ♮ 2.

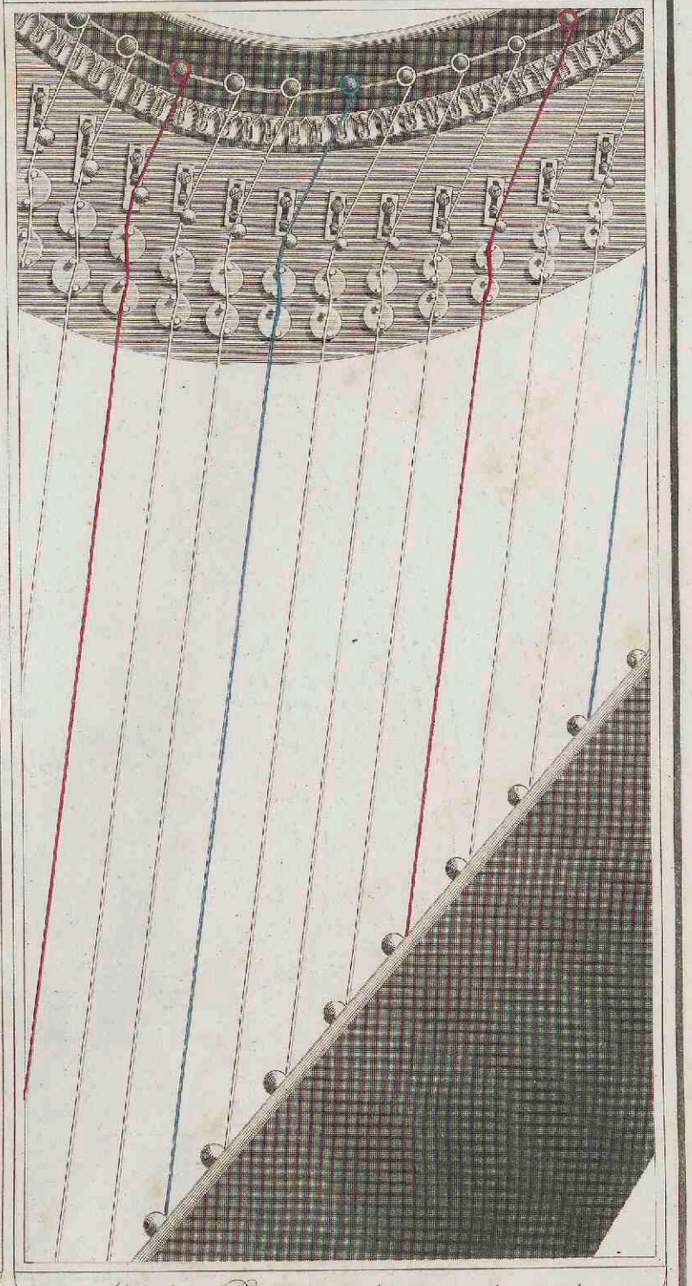
Strings shortened of one Semitone.

All the Pedals in the first notch.

C♮

Fig. ♯ 3.

Strings shortened of two Semitones.



All the Pedals in the second notch.

C♯

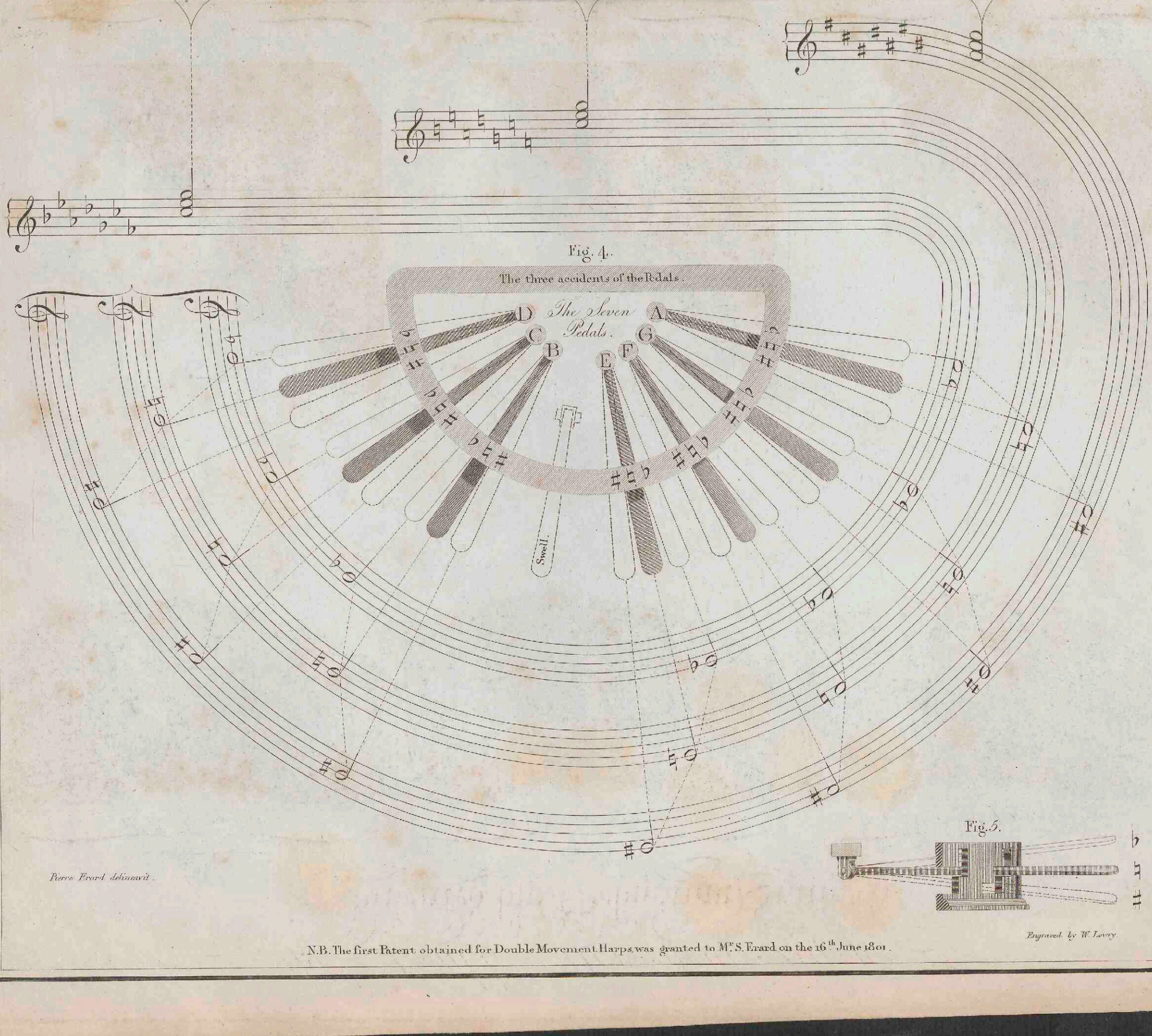


Fig. 4.

The three accidents of the Pedals.

Fig. 5.

Pierre Erard delineavit.

Engraved by W. Lowry.

N.B. The first Patent obtained for Double Movement Harps was granted to Mr. S. Erard on the 16th June 1801.