

Evil-thinking is either Envy or Ingratitude.

677.

Envy must be represented with a contemptuous motion of the hand towards heaven, because if she could she would use her strength against God; make her with her face covered by a mask of fair seeming; show her as wounded in the eye by a palm branch and by an olive-branch, and wounded in the ear by laurel and myrtle, to signify that victory and truth are odious to her. Many thunderbolts should proceed from her to signify her evil speaking. Let her be lean and haggard because she is in perpetual torment. Make her heart gnawed by a swelling serpent, and make her with a quiver with tongues serving as arrows, because she often offends with it. Give her a leopard's skin, because this creature kills the lion out of envy and by deceit. Give her too a vase in her hand full of flowers and scorpions and toads and other venomous creatures; make her ride upon death, because Envy, never dying, never tires of ruling. Make her bridle, and load her with divers kinds of arms because all her weapons are deadly.

Toleration.

Intolerable.

No sooner is Virtue born than Envy comes into the world to attack it; and sooner will there be a body without a shadow than Virtue without Envy.

[Footnote: The larger of the two drawings on PI. LXI is explained by the first 21 lines of this passage. L. 22 and 23, which are written above the space between the two drawings, do not seem to have any reference to either. L. 24-27 are below the allegorical twin figure which they serve to explain.]

678.

When Pluto's Paradise is opened, then there may be devils placed in twelve pots like openings into hell. Here will be Death, the Furies, ashes, many naked children weeping; living fires made of various colours....

679.

John the Baptist

Saint Augustin

Saint Peter

Paul

Elisabeth

Saint Clara.

Bernardino

Our Lady Louis  
Bonaventura  
Anthony of Padua.  
Saint Francis.  
Francis,  
Anthony, a lily and book;  
Bernardino with the [monogram of] Jesus,  
Louis with 3 fleur de lys on his breast and  
the crown at his feet,  
Bonaventura with Seraphim,  
Saint Clara with the tabernacle,  
Elisabeth with a Queen's crown.

[Footnote: 679. The text of the first six lines is written within a square space of the same size as the copy here given. The names are written in the margin following the order in which they are here printed. In lines 7--12 the names of those saints are repeated of whom it seemed necessary to point out the emblems.]

List of drawings.

680.

A head, full face, of a young man  
with fine flowing hair,  
Many flowers drawn from nature,

A head, full face, with curly hair,  
Certain figures of Saint Jerome,  
[6] The measurements of a figure,  
Drawings of furnaces.  
A head of the Duke,  
[9] many designs for knots,  
4 studies for the panel of Saint Angelo  
A small composition of Girolamo da Fegline,  
A head of Christ done with the pen,  
[13] 8 Saint Sebastians,  
Several compositions of Angels,  
A chalcedony,  
A head in profile with fine hair,  
Some pitchers seen in(?) perspective,  
Some machines for ships,  
Some machines for waterworks,  
A head, a portrait of Atalanta raising her  
face;  
The head of Geronimo da Fegline,  
The head of Gian Francisco Borso,  
Several throats of old women,  
Several heads of old men,  
Several nude figures, complete,  
Several arms, eyes, feet, and positions,  
A Madonna, finished,  
Another, nearly in profile,

Head of Our Lady ascending into Heaven,  
A head of an old man with long chin,  
A head of a gypsy girl,  
A head with a hat on,  
A representation of the Passion, a cast,  
A head of a girl with her hair gathered in a knot,  
A head, with the brown hair dressed.

[Footnote: 680. This has already been published by AMORETTI *Memorie storiche* cap. XVI. His reading varies somewhat from that here given, e. g. l. 5 and 6. *Certi Sangirolami in su d'una figura*; and instead of I. 13. *Un San Bastiano*.]

[Footnote: 680. 9. Molti disegni di gruppi. VASARI in his life of Leonardo (IV, 21, ed. MILANESI 1880) says: "Oltreché perse tempo fino a disegnare gruppi di corde fatti con ordine, e che da un capo seguissi tutto il resto fino all' altro, tanto che s'empiesi un tondo; che se ne vede in istampa uno difficilissimo e molto bello, e nel mezzo vi sono queste parole: Leonardus Vinci Accademia". Gruppi must here be understood as a technical expression for those twisted ornaments which are well known through wood cuts. AMORETTI mentions six different ones in the Ambrosian Library. I am indebted to M. DELABORDE for kindly informing me that the original blocks of these are preserved in his department in the Bibliothèque Nationale in Paris. On the cover of these volumes is a copy from one of them. The size of the original is 23 1/2

centimetres by 26 1/4. The centre portion of another is given on p. 361. G. Govi remarks on these ornaments (Saggio p. 22): "Codesti gruppi eran probabilmente destinati a servir di modello a ferri da rilegatori per adornar le cartelle degli scolari (?). Fregi somigliantissimi a questi troviamo infatti impressi in oro sui cartoni di vari volumi contemporanei, e li vediam pur figurare nelle lettere iniziali di alcune edizioni del tempo."

Dürer who copied them, omitting the inscription, added to the second impressions his own monogram. In his diary he designates them simply as "Die sechs Knoten" (see THAUSING, Life of A. Dürer I, 362, 363). In Leonardo's MSS. we find here and there little sketches or suggestions for similar ornaments. Compare too G. MONGERI, L'Arte in Milano, p. 315 where an ornament of the same character is given from the old decorations of the vaulted ceiling of the Sacristy of S. Maria delle Grazie.]

[Footnote: 680, 17. The meaning in which the word *coppi*, literally pitchers, is here used I am unable to determine; but a change to *copie* seems to me too doubtful to be risked.]

681.

Stubborn rigour.

Doomed rigour.

[Footnote: See Pl. LXII, No. 2, the two upper pen and ink drawings. The originals, in the Windsor collection are slightly washed with colour. The background is blue sky; the plough and the instrument with the compass are reddish brown, the sun is tinted yellow].

682.

Obstacles cannot crush me  
Every obstacle yields to stern resolve  
He who is fixed to a star does not change  
his mind.

[Footnote: This text is written to elucidate two sketches which were obviously the first sketches for the drawings reproduced on Pl LXII, No. 2.]

683.

Ivy is [a type] of longevity.

[Footnote: In the original there is, near this text, a sketch of a coat wreathed above the waist with ivy.]

684.

Truth     the sun.

falsehood a mask.

innocence,

malignity.

Fire destroys falsehood,  
that is sophistry, and  
restores truth, driving out  
darkness.

Fire may be represented as the destroy of  
all sophistry, and as the  
image and demonstration of truth;  
because it is light and drives  
out darkness which conceals  
all essences [or subtle things].

[Footnote: See Pl. LXIII. L. 1-8 are in the middle of the page; 1.  
9-14 to the right below; 1. 15-22 below in the middle column. The  
rest of the text is below the sketches on the left. There are some  
other passages on this page relating to geometry.]

TRUTH.

Fire destroys all sophistry, that is deceit;  
and maintains truth alone, that is gold.



Truth at last cannot be hidden.  
Dissimulation is of no avail. Dissimulation is  
to no purpose before  
so great a judge.  
Falsehood puts on a mask.  
Nothing is hidden under the sun.

Fire is to represent truth because it  
destroys all sophistry and lies; and the  
mask is for lying and falsehood  
which conceal truth.

685.

Movement will cease before we are  
weary  
of being useful.

Movement will fail sooner than usefulness.  
Death sooner than I am never weary of  
weariness. being useful,  
In serving others I is a motto for carnival.  
cannot do enough. Without fatigue.

No labour is  
sufficient to tire me.

Hands into which  
ducats and precious  
stones fall like snow; they  
never become tired by serving,  
but this service is only for its  
utility and not for our own benefit. I am never weary  
of being useful.

Naturally  
nature has so disposed me.

686.

This shall be placed in the  
hand of Ingratitude.  
Wood nourishes the fire that  
consumes it.

687.

TO REPRESENT INGRATITUDE.

When the sun appears  
which dispels darkness in  
general, you put out the

light which dispelled it  
for you in particular  
for your need and convenience.

688.

On this side Adam and Eve on the other;  
O misery of mankind, of how many things do  
you make yourself the slave for money!

[Footnote: See Pl. LXIV. The figures of Adam and Eve in the clouds  
here alluded to would seem to symbolise their superiority to all  
earthly needs.]

689.

Thus are base unions sundered.

[Footnote: A much blurred sketch is on the page by this text. It  
seems to represent an unravelled plait or tissue.]

690.

Constancy does not begin, but is that  
which perseveres.

[Footnote: A drawing in red chalk, also rubbed, which stands in the original in the middle of this text, seems to me to be intended for a sword hilt, held in a fist.]

691.

Love, Fear, and Esteem,--  
Write these on three stones. Of servants.

692.

Prudence Strength.

693.

Fame alone raises herself to Heaven,  
because virtuous things are in favour with God.

Disgrace should be represented upside  
down, because all her deeds are contrary to  
God and tend to hell.

694.

Short liberty.

695.

Nothing is so much to be feared as Evil

Report.

This Evil Report is born of life.

696.

Not to disobey.

697.

A felled tree which is shooting

again.

I am still hopeful.

A falcon,

Time.

[Footnote: I. Albero tagliato. This emblem was displayed during the Carnival at Florence in 1513. See VASARI VI, 251, ed. MILANESI 1881. But the coincidence is probably accidental.]

698.

Truth here makes Falsehood torment

lying tongues.

699.

Such as harm is when it hurts me not,  
is good which avails me not.

[Footnote: See PI. LX, No. 2. Compare this sketch with that on PI. LXII, No. 2. Below the two lines of the text there are two more lines: li gùchi (giunchi) che ritégò le paglucole (pagliucole) chelli (che li) anniegano.]

700.

He who offends others, does not secure himself.

[Footnote: See PI. LX, No. 3.]

701.

Ingratitude.

[Footnote: See PI. LX, No. 4. Below the bottom sketches are the unintelligible words "sta stilli." For "Ingratitudo" compare also Nos. 686 and 687.]

702.

One's thoughts turn towards Hope.

[Footnote: 702. By the side of this passage is a sketch of a cage with a bird sitting in it.]

Ornaments and Decorations for feasts (703-705).

703.

A bird, for a comedy.

[Footnote: The biographies say so much, and the author's notes say so little of the invention attributed to Leonardo of making artificial birds fly through the air, that the text here given is of exceptional interest from being accompanied by a sketch. It is a very slight drawing of a bird with outspread wings, which appears to be sliding down a stretched string. Leonardo's flying machines and his studies of the flight of birds will be referred to later.]

704.

A DRESS FOR THE CARNIVAL.

To make a beautiful dress cut it in thin cloth and give it an

odoriferous varnish, made of oil of turpentine and of varnish in grain, with a pierced stencil, which must be wetted, that it may not stick to the cloth; and this stencil may be made in a pattern of knots which afterwards may be filled up with black and the ground with white millet.[Footnote 7: The grains of black and white millet would stick to the varnish and look like embroidery.]

[Footnote: Ser Giuliano, da Vinci the painter's brother, had been commissioned, with some others, to order and to execute the garments of the Allegorical figures for the Carnival at Florence in 1515--16; VASARI however is incorrect in saying of the Florentine Carnival of 1513: "equelli che feciono ed ordinarono gli abiti delle figure furono Ser Piero da Vinci, padre di Lonardo, e Bernardino di Giordano, bellissimi ingegni" (See MILANESI'S ed. Voi. VI, pg. 251.)]

705.

Snow taken from the high peaks of mountains might be carried to hot places and let to fall at festivals in open places at summer time.

\*\*\* End of Volume 1



The Notebooks of Leonardo Da Vinci

Volume 2

Translated by Jean Paul Richter

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XI.

The notes on Sculpture.

Compared with the mass of manuscript treating of Painting, a very small number of passages bearing on the practice and methods of Sculpture are to be found scattered through the note books; these are here given at the beginning of this section (Nos. 706-709).

There is less cause for surprise at finding that the equestrian statue of Francesco Sforza is only incidentally spoken of; for, although Leonardo must have worked at it for a long succession of years, it is not in the nature of the case that it could have given

rise to much writing. We may therefore regard it as particularly fortunate that no fewer than thirteen notes in the master's handwriting can be brought together, which seem to throw light on the mysterious history of this famous work. Until now writers on Leonardo were acquainted only with the passages numbered 712, 719, 720, 722 and 723.

In arranging these notes on sculpture I have given the precedence to those which treat of the casting of the monument, not merely because they are the fullest, but more especially with a view to reconstructing the monument, an achievement which really almost lies within our reach by combining and comparing the whole of the materials now brought to light, alike in notes and in sketches.

A good deal of the first two passages, Nos. 710 and 711, which refer to this subject seems obscure and incomprehensible; still, they supplement each other and one contributes in no small degree to the comprehension of the other. A very interesting and instructive commentary on these passages may be found in the fourth chapter of Vasari's *Introduzione della Scultura* under the title "Come si fanno i modelli per fare di bronzo le figure grandi e piccole, e come le forme per buttarle; come si armino di ferri, e come si gettino di metallo," &c. Among the drawings of models of the moulds for casting we find only one which seems to represent the horse in the act of galloping--No. 713. All the other designs show the horse as pacing quietly and as these studies of the horse are accompanied by copious

notes as to the method of casting, the question as to the position of the horse in the model finally selected, seems to be decided by preponderating evidence. "Il cavallo dello Sforza"--C. Boito remarks very appositely in the Saggio on page 26, "doveva sembrare fratello al cavallo del Colleoni. E si direbbe che questo fosse figlio del cavallo del Gattamelata, il quale pare figlio di uno dei quattro cavalli che stavano forse sull' Arco di Nerone in Roma" (now at Venice). The publication of the Saggio also contains the reproduction of a drawing in red chalk, representing a horse walking to the left and supported by a scaffolding, given here on Pl. LXXVI, No. 1. It must remain uncertain whether this represents the model as it stood during the preparations for casting it, or whether--as seems to me highly improbable--this sketch shows the model as it was exhibited in 1493 on the Piazza del Castello in Milan under a triumphal arch, on the occasion of the marriage of the Emperor Maximilian to Bianca Maria Sforza. The only important point here is to prove that strong evidence seems to show that, of the numerous studies for the equestrian statue, only those which represent the horse pacing agree with the schemes of the final plans.

The second group of preparatory sketches, representing the horse as galloping, must therefore be considered separately, a distinction which, in recapitulating the history of the origin of the monument seems justified by the note given under No. 720.

Galeazzo Maria Sforza was assassinated in 1476 before his scheme for

erecting a monument to his father Francesco Sforza could be carried into effect. In the following year Ludovico il Moro the young aspirant to the throne was exiled to Pisa, and only returned to Milan in 1479 when he was Lord (Governatore) of the State of Milan, in 1480 after the minister Cecco Simonetta had been murdered. It may have been soon after this that Ludovico il Moro announced a competition for an equestrian statue, and it is tolerably certain that Antonio del Pollajuolo took part in it, from this passage in Vasari's Life of this artist: "E si trovo, dopo la morte sua, il disegno e modello che a Lodovico Sforza egli aveva fatto per la statua a cavallo di Francesco Sforza, duca di Milano; il quale disegno e nel nostro Libro, in due modi: in uno egli ha sotto Verona; nell'altro, egli tutto armato, e sopra un basamento pieno di battaglie, fa saltare il cavallo addosso a un armato; ma la cagione perche non mettesse questi disegni in opera, non ho gia potuto sapere." One of Pollajuolo's drawings, as here described, has lately been discovered by Senatore Giovanni Morelli in the Munich Pinacothek. Here the profile of the horseman is a portrait of Francesco Duke of Milan, and under the horse, who is galloping to the left, we see a warrior thrown and lying on the ground; precisely the same idea as we find in some of Leonardo's designs for the monument, as on Pl. LXVI, LXVII, LXVIII, LXIX and LXXII No. 1; and, as it is impossible to explain this remarkable coincidence by supposing that either artist borrowed it from the other, we can only conclude that in the terms of the competition the subject proposed was the Duke on a horse in full gallop, with a fallen foe under its

hoofs.

Leonardo may have been in the competition there and then, but the means for executing the monument do not seem to have been at once forthcoming. It was not perhaps until some years later that Leonardo in a letter to the Duke (No. 719) reminded him of the project for the monument. Then, after he had obeyed a summons to Milan, the plan seems to have been so far modified, perhaps in consequence of a remonstrance on the part of the artist, that a pacing horse was substituted for one galloping, and it may have been at the same time that the colossal dimensions of the statue were first decided on. The designs given on Pl. LXX, LXXI, LXXII, 2 and 3, LXXIII and LXXIV and on pp. 4 and 24, as well as three sketches on Pl. LXIX may be studied with reference to the project in its new form, though it is hardly possible to believe that in either of these we see the design as it was actually carried out. It is probable that in Milan Leonardo worked less on drawings, than in making small models of wax and clay as preparatory to his larger model. Among the drawings enumerated above, one in black chalk, Pl. LXXIII--the upper sketch on the right hand side, reminds us strongly of the antique statue of Marcus Aurelius. If, as it would seem, Leonardo had not until then visited Rome, he might easily have known this statue from drawings by his former master and friend Verrocchio, for Verrocchio had been in Rome for a long time between 1470 and 1480. In 1473 Pope Sixtus IV had this antique equestrian statue restored and placed on a new pedestal in front of the church of San Giovanni in Luterano.

Leonardo, although he was painting independently as early as in 1472 is still spoken of as working in Verrocchio's studio in 1477. Two years later the Venetian senate decided on erecting an equestrian statue to Colleoni; and as Verrocchio, to whom the work was entrusted, did not at once move from Florence to Venice--where he died in 1488 before the casting was completed--but on the contrary remained in Florence for some years, perhaps even till 1485, Leonardo probably had the opportunity of seeing all his designs for the equestrian statue at Venice and the red chalk drawing on Pl. LXXIV may be a reminiscence of it.

The pen and ink drawing on Pl. LXXII, No. 3, reminds us of Donatello's statue of Gattamelata at Padua. However it does not appear that Leonardo was ever at Padua before 1499, but we may conclude that he took a special interest in this early bronze statue and the reports he could procure of it, form an incidental remark which is to be found in C. A. 145a; 432a, and which will be given in Vol. II under Ricordi or Memoranda. Among the studies--in the widest sense of the word--made in preparation statue we may include the Anatomy of the Horse which Lomazzo and Vas mention; the most important parts of this work still exist in the Queen's Li Windsor. It was beyond a doubt compiled by Leonardo when at Milan; only interesting records to be found among these designs are reproduced in Nos. 716a but it must be pointed out that out of 40 sheets of studies of the movements of the belonging to that treatise, a horse in full gallop occurs but once.

If we may trust the account given by Paulus Jovius--about 1527--Leonardo's horse was represented as "vehementer incitatus et anhelatus". Jovius had probably seen the model exhibited at Milan; but, need we, in fact, infer from this description that the horse was galloping? Compare Vasari's description of the Gattamelata monument at Padua: "Egli [Donatello] vi ando ben volentieri, e fece il cavallo di bronzo, che e in sulla piazza di Sant Antonio, nel quale si dimostra lo sbuffamento ed il fremito del cavallo, ed il grande animo e la fierezza vivacissimamente espressa dall'arte nella figura che lo cavalca".

These descriptions, it seems to me, would only serve to mark the difference between the work of the middle ages and that of the renaissance.

We learn from a statement of Sabba da Castiglione that, when Milan was taken by the French in 1499, the model sustained some injury; and this informant, who, however is not invariably trustworthy, adds that Leonardo had devoted fully sixteen years to this work (la forma del cavallo, intorno a cui Leonardo avea sedici anni continui consumati). This often-quoted passage has given ground for an assumption, which has no other evidence to support it, that Leonardo had lived in Milan ever since 1483. But I believe it is nearer the truth to suppose that this author's statement alludes to the fact that about sixteen years must have past since the competition in

which Leonardo had taken part.

I must in these remarks confine myself strictly to the task in hand and give no more of the history of the Sforza monument than is needed to explain the texts and drawings I have been able to reproduce. In the first place, with regard to the drawings, I may observe that they are all, with the following two exceptions, in the Queen's Library at Windsor Castle; the red chalk drawing on Pl. LXXVI No. 1 is in the MS. C. A. (see No. 712) and the fragmentary pen and ink drawing on page 4 is in the Ambrosian Library. The drawings from Windsor on Pl. LXVI have undergone a trifling reduction from the size of the originals.

There can no longer be the slightest doubt that the well-known engraving of several horsemen (Passavant, *Le Peintre-Graveur*, Vol. V, p. 181, No. 3) is only a copy after original drawings by Leonardo, executed by some unknown engraver; we have only to compare the engraving with the facsimiles of drawings on Pl. LXV, No. 2, Pl. LXVII, LXVIII and LXIX which, it is quite evident, have served as models for the engraver.

On Pl. LXV No. 1, in the larger sketch to the right hand, only the base is distinctly visible, the figure of the horseman is effaced. Leonardo evidently found it unsatisfactory and therefore rubbed it out.



The base of the monument--the pedestal for the equestrian statue--is repeatedly sketched on a magnificent plan. In the sketch just mentioned it has the character of a shrine or aedicula to contain a sarcophagus. Captives in chains are here represented on the entablature with their backs turned to that portion of the monument which more

strictly constitutes the pedestal of the horse. The lower portion of the aedicula is surrounded by columns. In the pen and ink drawing Pl. LXVI--the lower drawing on the right hand side--the sarcophagus is shown between the columns, and above the entablature is a plinth on which the horse stands. But this arrangement perhaps seemed to Leonardo to lack solidity, and in the little sketch on the left hand, below, the sarcophagus is shown as lying under an arched canopy. In this the trophies and the captive warriors are detached from the angles. In the first of these two sketches the place for the trophies is merely indicated by a few strokes; in the third sketch on the left the base is altogether broader, buttresses and pinnacles having been added so as to form three niches. The black chalk drawing on Pl. LXVIII shows a base in which the angles are formed by niches with pilasters. In the little sketch to the extreme left on Pl. LXV, No. 1, the equestrian statue serves to crown a circular temple somewhat resembling Bramante's tempietto of San Pietro in Montorio at Rome, while the sketch above to the right displays an arrangement faintly reminding us of the tomb of the Scaligers in Verona. The base is thus constructed of two platforms

or slabs, the upper one considerably smaller than the lower one which is supported on flying buttresses with pinnacles.

On looking over the numerous studies in which the horse is not galloping but merely walking forward, we find only one drawing for the pedestal, and this, to accord with the altered character of the statue, is quieter and simpler in style (Pl. LXXIV). It rises almost vertically from the ground and is exactly as long as the pacing horse. The whole base is here arranged either as an independent baldaquin or else as a projecting canopy over a recess in which the figure of the deceased Duke is seen lying on his sarcophagus; in the latter case it was probably intended as a tomb inside a church. Here, too, it was intended to fill the angles with trophies or captive warriors. Probably only No. 724 in the text refers to the work for the base of the monument.

If we compare the last mentioned sketch with the description of a plan for an equestrian monument to Gian Giacomo Trivulzio (No. 725) it seems by no means impossible that this drawing is a preparatory study for the very monument concerning which the manuscript gives us detailed information. We have no historical record regarding this sketch nor do the archives in the Trivulzio Palace give us any information. The simple monument to the great general in San Nazaro Maggiore in Milan consists merely of a sarcophagus placed in recess high on the wall of an octagonal chapel. The figure of the warrior is lying on the sarcophagus, on which his name is inscribed; a piece

of sculpture which is certainly not Leonardo's work. Gian Giacomo Trivulzio died at Chartres in 1518, only five months before Leonardo, and it seems to me highly improbable that this should have been the date of this sketch; under these circumstances it would have been done under the auspices of Francis I, but the Italian general was certainly not in favour with the French monarch at the time. Gian Giacomo Trivulzio was a sworn foe to Ludovico il Moro, whom he strove for years to overthrow. On the 6th September 1499 he marched victorious into Milan at the head of a French army. In a short time, however, he was forced to quit Milan again when Ludovico il Moro bore down upon the city with a force of Swiss troops. On the 15th of April following, after defeating Lodovico at Novara, Trivulzio once more entered Milan as a Conqueror, but his hopes of becoming Governatore of the place were soon wrecked by intrigue. This victory and triumph, historians tell us, were signalised by acts of vengeance against the dethroned Sforza, and it might have been particularly flattering to him that the casting and construction of the Sforza monument were suspended for the time.

It must have been at this moment--as it seems to me--that he commissioned the artist to prepare designs for his own monument, which he probably intended should find a place in the Cathedral or in some other church. He, the husband of Margherita di Nicolino Colleoni, would have thought that he had a claim to the same distinction and public homage as his less illustrious connection had received at the hands of the Venetian republic. It was at this very

time that Trivulzio had a medal struck with a bust portrait of himself and the following remarkable inscription on the reverse:  
DEO FAVENTE--1499--DICTVS--10--IA--EXPVLIT--LVDOVICV--SF--  
(Sfortiam) DVC-- (ducem) MLI (Mediolani)--NOIE  
(nomine)--REGIS--FRANCORVM--EODEM--ANN --(anno) RED'T (redit)--LVS  
(Ludovicus)--SVPERATVS ET CAPTVS--EST--AB--EO. In the Library of the Palazzo Trivulzio there is a MS. of Callimachus Siculus written at the end of the XVth or beginning of the XVIth century. At the beginning of this MS. there is an exquisite illuminated miniature of an equestrian statue with the name of the general on the base; it is however very doubtful whether this has any connection with Leonardo's design.

Nos. 731-740, which treat of casting bronze, have probably a very indirect bearing on the arrangements made for casting the equestrian statue of Francesco Sforza. Some portions evidently relate to the casting of cannon. Still, in our researches about Leonardo's work on the monument, we may refer to them as giving us some clue to the process of bronze casting at that period.

Some practical hints (706-709).

706.

OF A STATUE.

If you wish to make a figure in marble, first make one of clay, and when you have finished it, let it dry and place it in a case which should be large enough, after the figure is taken out of it, to receive also the marble, from which you intend to reveal the figure in imitation of the one in clay. After you have put the clay figure into this said case, have little rods which will exactly slip in to the holes in it, and thrust them so far in at each hole that each white rod may touch the figure in different parts of it. And colour the portion of the rod that remains outside black, and mark each rod and each hole with a countersign so that each may fit into its place. Then take the clay figure out of this case and put in your piece of marble, taking off so much of the marble that all your rods may be hidden in the holes as far as their marks; and to be the better able to do this, make the case so that it can be lifted up; but the bottom of it will always remain under the marble and in this way it can be lifted with tools with great ease.

707.

Some have erred in teaching sculptors to measure the limbs of their figures with threads as if they thought that these limbs were equally round in every part where these threads were wound about them.

708.

## MEASUREMENT AND DIVISION OF A STATUE.

Divide the head into 12 degrees, and each degree divide into 12 points, and each point into 12 minutes, and the minutes into minims and the minims into semi minims.

Degree--point--minute--minim.

709.

Sculptured figures which appear in motion, will, in their standing position, actually look as if they were falling forward.

[Footnote: figure di rilievo. Leonardo applies this term exclusively to wholly detached figures, especially to those standing free. This note apparently refers to some particular case, though we have no knowledge of what that may have been. If we suppose it to refer to the first model of the equestrian statue of Francesco Sforza (see the introduction to the notes on Sculpture) this observation may be regarded as one of his arguments for abandoning the first scheme of the Sforza Monument, in which the horse was to be galloping (see page 2). It is also in favour of this theory that the note is written in a manuscript volume already completed in 1492. Leonardo's opinions as to the shortcomings of plastic works when compared with paintings are given under No. 655 and 656.]

Notes on the casting of the Sforza monument (710-715).

710.

Three braces which bind the mould.

[If you want to make simple casts quickly, make them in a box of river sand wetted with vinegar.]

[When you shall have made the mould upon the horse you must make the thickness of the metal in clay.]

Observe in alloying how many hours are wanted for each hundredweight. [In casting each one keep the furnace and its fire well stopped up.] [Let the inside of all the moulds be wetted with linseed oil or oil of turpentine, and then take a handful of powdered borax and Greek pitch with aqua vitae, and pitch the mould over outside so that being under ground the damp may not [damage it?]

[To manage the large mould make a model of the small mould, make a small room in proportion.]

[Make the vents in the mould while it is on the horse.]

Hold the hoofs in the tongs, and cast them with fish glue. Weigh the

parts of the mould and the quantity of metal it will take to fill them, and give so much to the furnace that it may afford to each part its amount of metal; and this you may know by weighing the clay of each part of the mould to which the quantity in the furnace must correspond. And this is done in order that the furnace for the legs when filled may not have to furnish metal from the legs to help out the head, which would be impossible. [Cast at the same casting as the horse the little door]

[Footnote: The importance of the notes included under this number is not diminished by the fact that they have been lightly crossed out with red chalk. Possibly they were the first scheme for some fuller observations which no longer exist; or perhaps they were crossed out when Leonardo found himself obliged to give up the idea of casting the equestrian statue. In the original the first two sketches are above l. 1, and the third below l. 9.]

711.

#### THE MOULD FOR THE HORSE.

Make the horse on legs of iron, strong and well set on a good foundation; then grease it and cover it with a coating, leaving each coat to dry thoroughly layer by layer; and this will thicken it by the breadth of three fingers. Now fix and bind it with iron as may be necessary. Moreover take off the mould and then make the



thickness. Then fill the mould by degrees and make it good throughout; encircle and bind it with its irons and bake it inside where it has to touch the bronze.

#### OF MAKING THE MOULD IN PIECES.

Draw upon the horse, when finished, all the pieces of the mould with which you wish to cover the horse, and in laying on the clay cut it in every piece, so that when the mould is finished you can take it off, and then recompose it in its former position with its joins, by the countersigns.

The square blocks a b will be between the cover and the core, that is in the hollow where the melted bronze is to be; and these square blocks of bronze will support the intervals between the mould and the cover at an equal distance, and for this reason these squares are of great importance.

The clay should be mixed with sand.

Take wax, to return [what is not used] and to pay for what is used.

Dry it in layers.

Make the outside mould of plaster, to save time in drying and the expense in wood; and with this plaster enclose the irons [props]

both outside and inside to a thickness of two fingers; make terra cotta. And this mould can be made in one day; half a boat load of plaster will serve you.

Good.

Dam it up again with glue and clay, or white of egg, and bricks and rubbish.

[Footnote: See Pl. LXXV. The figure "40," close to the sketch in the middle of the page between lines 16 and 17 has been added by a collector's hand.

In the original, below line 21, a square piece of the page has been cut out about 9 centimetres by 7 and a blank piece has been gummed into the place.

Lines 22-24 are written on the margin. l. 27 and 28 are close to the second marginal sketch. l. 42 is a note written above the third marginal sketch and on the back of this sheet is the text given as No. 642. Compare also No. 802.]

712.

All the heads of the large nails.

[Footnote: See Pl. LXXVI, No. i. This drawing has already been published in the "Saggio delle Opere di L. da Vinci." Milano 1872, Pl. XXIV, No. i. But, for various reasons I cannot regard the editor's suggestions as satisfactory. He says: "Veggonsi le armature di legname colle quali forse venne sostenuto il modello, quando per le nozze di Bianca Maria Sforza con Massimiliano imperatore, esso fu collocato sotto un arco trionfale davanti al Castello."

713.

These bindings go inside.

714.

Salt may be made from human excrements, burnt and calcined, made into lees and dried slowly at a fire, and all the excrements produce salt in a similar way and these salts when distilled, are very strong.

[Footnote: VASARI repeatedly states, in the fourth chapter of his *Introduzione della Scultura*, that in preparing to cast bronze statues horse-dung was frequently used by sculptors. If, notwithstanding this, it remains doubtful whether I am justified in having introduced here this text of but little interest, no such doubt can be attached to the sketch which accompanies it.]

715.

METHOD OF FOUNDING AGAIN.

This may be done when the furnace is made [Footnote: this note is written below the sketches.] strong and bruised.

Models for the horse of the Sforza monument (716-718).

716.

Messer Galeazzo's big genet

717.

Messer Galeazzo's Sicilian horse.

[Footnote: These notes are by the side of a drawing of a horse with figured measurements.]

718.

Measurement of the Sicilian horse the leg from behind, seen in front, lifted and extended.

[Footnote: There is no sketch belonging to this passage. Galeazze here probably means Galeazze di San Severino, the famous captain who married Bianca the daughter of Ludovico il Moro.]

Occasional references to the Sforza monument (719-724).

719.

Again, the bronze horse may be taken in hand, which is to be to the immortal glory and eternal honour of the happy memory of the prince your father, and of the illustrious house of Sforza.

[Footnote: The letter from which this passage is here extracted will be found complete in section XXI. (see the explanation of it, on page 2).]

720.

On the 23rd of April 1490 I began this book, and recommenced the horse.

721.

There is to be seen, in the mountains of Parma and Piacenza, a multitude of shells and corals full of holes, still sticking to the rocks, and when I was at work on the great horse for Milan, a large

sackful of them, which were found thereabout, was brought to me into my workshop, by certain peasants.

722.

Believe me, Leonardo the Florentine, who has to do the equestrian bronze statue of the Duke Francesco that he does not need to care about it, because he has work for all his life time, and, being so great a work, I doubt whether he can ever finish it. [Footnote: This passage is quoted from a letter to a committee at Piacenza for whom Leonardo seems to have undertaken to execute some work. The letter is given entire in section XXL; in it Leonardo remonstrates as to some unreasonable demands.]

723.

Of the horse I will say nothing because I know the times. [Footnote: This passage occurs in a rough copy of a letter to Ludovico il Moro, without date (see below among the letters).]

724.

During ten years the works on the marbles have been going on I will not wait for my payment beyond the time, when my works are finished. [Footnote: This possibly refers to the works for the pedestal of the equestrian statue concerning which we have no farther information in

the MSS. See p. 6.]

The project of the Trivulzio monument.

725.

THE MONUMENT TO MESSER GIOVANNI JACOMO DA TREVULZO.

[2] Cost of the making and materials for the horse [5].

[Footnote: In the original, lines 2-5, 12-14, 33-35, are written on the margin. This passage has been recently published by G. Govi in Vol. V, Ser. 3a, of *Transunti, Reale Accademia dei Lincei*, sed. del 5 Giugno, 1881, with the following introductory note: "Desidero intanto che siano stampati questi pochi frammenti perche so che sono stati trascritti ultimamente, e verranno messi in luce tra poco fuori d'Italia. Li ripubblichi pure chi vuole, ma si sappia almeno che anche tra noi si conoscevano, e s'eran raccolti da anni per comporne, quando che fosse, una edizione ordinata degli scritti di Leonardo."

The learned editor has left out line 22 and has written 3 pie for 8 piedi in line 25. There are other deviations of less importance from the original.]

A courser, as large as life, with the rider requires for the cost of

the metal, duc. 500.

And for cost of the iron work which is inside the model, and charcoal, and wood, and the pit to cast it in, and for binding the mould, and including the furnace where it is to be cast ... duc. 200.

To make the model in clay and then in wax..... duc. 432.

To the labourers for polishing it when it is cast. .... duc. 450.

in all. . duc. 1582.

[12] Cost of the marble of the monument [14].

Cost of the marble according to the drawing. The piece of marble under the horse which is 4 braccia long, 2 braccia and 2 inches wide and 9 inches thick 58 hundredweight, at 4 Lire and 10 Soldi per hundredweight.. duc. 58.

And for 13 braccia and 6 inches of cornice, 7 in. wide and 4 in. thick, 24 hundredweight..... duc. 24.

And for the frieze and architrave, which is 4 br. and 6 in. long, 2 br. wide and 6 in. thick, 29 hundredweight., duc. 20.



And for the capitals made of metal, which are 8, 5 inches in. square and 2 in. thick, at the price of 15 ducats each, will come to.....  
duc. 122.

And for 8 columns of 2 br. 7 in., 4 1/2 in. thick, 20 hundredweight  
duc. 20.

And for 8 bases which are 5 1/2 in. square and 2 in. high 5 hund'..  
duc. 5.

And for the slab of the tombstone 4 br. 10 in. long, 2 br. 4 1/2 in.  
wide 36 hundredweight..... duc. 36.

And for 8 pedestal feet each 8 br. long and 6 1/2 in. wide and 6 1/2  
in. thick, 20 hundredweight come to... duc. 20.

And for the cornice below which is 4 br. and 10 in. long, and 2 br.  
and 5 in. wide, and 4 in. thick, 32 hund'.. duc. 32.

And for the stone of which the figure of the deceased is to be made  
which is 3 br. and 8 in. long, and 1 br. and 6 in. wide, and 9 in.  
thick, 30 hund'.. duc. 30.

And for the stone on which the figure lies which is 3 br. and 4 in.  
long and 1 br. and 2 in., wide and 4 1/2 in. thick duc. 16.

And for the squares of marble placed between the pedestals which are 8 and are 9 br. long and 9 in. wide, and 3 in. thick, 8 hundredweight . . . duc. 8. in all. . duc. 389.

[33]Cost of the work in marble[35].

Round the base on which the horse stands there are 8 figures at 25 ducats each ..... duc. 200.

And on the same base there are 8 festoons with some other ornaments, and of these there are 4 at the price of 15 ducats each, and 4 at the price of 8 ducats each ..... duc. 92.

And for squaring the stones duc. 6.

Again, for the large cornice which goes below the base on which the horse stands, which is 13 br. and 6 in., at 2 due. per br. .... duc. 27.

And for 12 br. of frieze at 5 due. per br. .... duc. 60.

And for 12 br. of architrave at 1 1/2 duc. per br. .... duc. 18.

And for 3 rosettes which will be the soffit of the monument, at 20 ducats each ..... duc. 60.

And for 8 fluted columns at 8 ducats each ..... duc. 64.

And for 8 bases at 1 ducat each, duc. 8.

And for 8 pedestals, of which 4 are at 10 duc. each, which go above the angles; and 4 at 6 duc. each .. duc. 64.

And for squaring and carving the moulding of the pedestals at 2 duc. each, and there are 8 .... duc. 16.

And for 6 square blocks with figures and trophies, at 25 duc. each .. duc. 150.

And for carving the moulding of the stone under the figure of the deceased ..... duc. 40.

For the statue of the deceased, to do it well ..... duc. 100.

For 6 harpies with candelabra, at 25 ducats each ..... duc. 150.

For squaring the stone on which the statue lies, and carving the moulding ..... duc. 20.

in all .. duc. 1075.

The sum total of every thing added together amount to ..... duc.

3046.

726.

MINT AT ROME.

It can also be made without a spring. But the screw above must always be joined to the part of the movable sheath: [Margin note: The mint of Rome.] [Footnote: See Pl. LXXVI. This passage is taken from a note book which can be proved to have been used in Rome.]

All coins which do not have the rim complete, are not to be accepted as good; and to secure the perfection of their rim it is requisite that, in the first place, all the coins should be a perfect circle; and to do this a coin must before all be made perfect in weight, and size, and thickness. Therefore have several plates of metal made of the same size and thickness, all drawn through the same gauge so as to come out in strips. And out of [24] these strips you will stamp the coins, quite round, as sieves are made for sorting chestnuts [27]; and these coins can then be stamped in the way indicated above; &c.

[31] The hollow of the die must be uniformly wider than the lower, but imperceptibly [35].

This cuts the coins perfectly round and of the exact thickness, and weight; and saves the man who cuts and weighs, and the man who makes the coins round. Hence it passes only through the hands of the gauger and of the stamper, and the coins are very superior.

[Footnote: See Pl. LXXVI No. 2. The text of lines 31-35 stands parallel 1. 24-27.]

Farther evidence of Leonardo's occupations and engagements at Rome under Pope Leo X. may be gathered from some rough copies of letters which will be found in this volume. Hitherto nothing has been known of his work in Rome beyond some doubtful, and perhaps mythical, statements in Vasari.]

727.

#### POWDER FOR MEDALS.

The incombustible growth of soot on wicks reduced to powder, burnt tin and all the metals, alum, isinglass, smoke from a brass forge, each ingredient to be moistened, with aqua vitae or malmsey or strong malt vinegar, white wine or distilled extract of turpentine, or oil; but there should be little moisture, and cast in moulds.

[Margin note: On the coining of medals (727. 728).] [Footnote: The meaning of scagliuolo in this passage is doubtful.]

728.

## OF TAKING CASTS OF MEDALS.

A paste of emery mixed with aqua vitae, or iron filings with vinegar, or ashes of walnut leaves, or ashes of straw very finely powdered.

[Footnote: The meaning of scagliuolo in this passage is doubtful.]

The diameter is given in the lead enclosed; it is beaten with a hammer and several times extended; the lead is folded and kept wrapped up in parchment so that the powder may not be spilt; then melt the lead, and the powder will be on the top of the melted lead, which must then be rubbed between two plates of steel till it is thoroughly pulverised; then wash it with aqua fortis, and the blackness of the iron will be dissolved leaving the powder clean.

Emery in large grains may be broken by putting it on a cloth many times doubled, and hit it sideways with the hammer, when it will break up; then mix it little by little and it can be founded with ease; but if you hold it on the anvil you will never break it, when it is large.

Any one who grinds smalt should do it on plates of tempered steel with a cone shaped grinder; then put it in aqua fortis, which melts away the steel that may have been worked up and mixed with the

smalt, and which makes it black; it then remains purified and clean; and if you grind it on porphyry the porphyry will work up and mix with the smalt and spoil it, and aqua fortis will never remove it because it cannot dissolve the porphyry.

If you want a fine blue colour dissolve the smalt made with tartar, and then remove the salt.

Vitrified brass makes a fine red.

729.

STUCCO.

Place stucco over the prominence of the..... which may be composed of Venus and Mercury, and lay it well over that prominence of the thickness of the side of a knife, made with the ruler and cover this with the bell of a still, and you will have again the moisture with which you applied the paste. The rest you may dry [Margin note: On stucco (729. 730).] [Footnote: In this passage a few words have been written in a sort of cipher--that is to say backwards; as in l. 3 erenev for Venere, l. 4 oirucem for Mercurio, l. 12 il orreve co ecarob for il everro (?) co borace. The meaning of the word before "di gesso" in l. 1 is unknown; and the sense, in which sagoma is used here and in other passages is obscure.-- Venere and Mercurio may mean 'marble' and 'lime', of which

stucco is composed.

12. The meaning of orreve is unknown.]

well; afterwards fire it, and beat it or burnish it with a good burnisher, and make it thick towards the side.

STUCCO.

Powder ... with borax and water to a paste, and make stucco of it, and then heat it so that it may dry, and then varnish it, with fire, so that it shines well.

730.

STUCCO FOR MOULDING.

Take of butter 6 parts, of wax 2 parts, and as much fine flour as when put with these 2 things melted, will make them as firm as wax or modelling clay.

GLUE.

Take mastic, distilled turpentine and white lead.

On bronze casting generally (731-740).



731.

TO CAST.

Tartar burnt and powdered with plaster and cast cause the plaster to hold together when it is mixed up again; and then it will dissolve in water.

732.

TO CAST BRONZE IN PLASTER.

Take to every 2 cups of plaster 1 of ox-horns burnt, mix them together and make your cast with it.

733.

When you want to take a cast in wax, burn the scum with a candle, and the cast will come out without bubbles.

734.

2 ounces of plaster to a pound of metal;-- walnut, which makes it like the curve.

[Footnote: The second part of this is quite obscure.]

735.

[Dried earth 16 pounds, 100 pounds of metal wet clay 20,--of wet 100,-half,- which increases 4 lbs. of water,--1 of wax, 1 lb. of metal, a little less,-the scrapings of linen with earth, measure for measure.] [Footnote: The translation is given literally, but the meaning is quite obscure.]

736.

Such as the mould is, so will the cast be.

737.

#### HOW CASTS OUGHT TO BE POLISHED.

Make a bunch of iron wire as thick as thread, and scrub them with [this and] water; hold a bowl underneath that it may not make a mud below.

#### HOW TO REMOVE THE ROUGH EDGES FROM BRONZE.

Make an iron rod, after the manner of a large chisel, and with this rub over those seams on the bronze which remain on the casts of the