

Vacuum and Pressure Platinum Casting

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After my high school years, I studied engineering. During my years at high school and university, I already spent every free hour at my father's company. I gained my practical experience by working, training and studying for more than 10 years.

At that company, we developed and produced the first closed vacuum casting systems in the beginning of the sixties. The melting part took place under controlled atmosphere, with vacuum in the flask chamber and direct vertical casting from the bottom of the crucible into the flask. The melting was done by induction heating.

In 1983 I founded Schultheiss Heating and Casting Technologies. My new company started with the design and production of temperature regulation systems for soldering/brazing, soldering/brazing wire feeders and control systems. These soldering/brazing systems were available from manually operated systems via fully automatic systems up to the complete soldering/brazing outfit.

These systems were followed by melting, granulating, continuous casting equipment (with patent rights on new technologies)

CASTING EVOLUTION

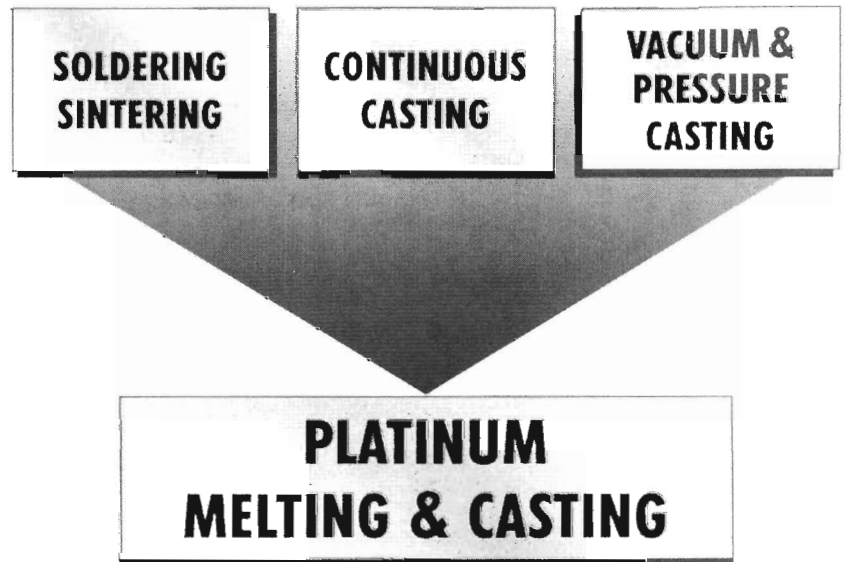


Figure 1: Casting Evolution

After this a series of Vacuum and Pressure Casting units (with patent rights) was developed, which comprises 14 different unit sizes in 3 technologies.

Casting Evolution (Figure 1)

More and more the customers demanded better solutions in the Platinum melting and casting field.

Our know how out of the development of the produced systems together with extensive experience leads to the research and to develop solutions for the platinum field.

The Platinum- Melting Unit, the Platinum- Jewelry Casting Unit and the Platinum Burnout Furnace with Rotation were constructed tested and put in production.

History of casting (Figure 2)

Manual gravity casting has been applied for thousands of years. In the museum of Bahrain, sepia casting of jewelry is shown of the period of 4000 BC. See 1.

Many hundred years later followed the *manual centrifugal casting*. See 2.

Centrifugal casting with spin axis, for example the spring centrifuge and the centrifugal casting with driving motor and induction heating followed. See 3 & 4.

The *Vacuum assisted casting* with open metal pouring and melting, (for example: with a burner) was the next technology to improve the castings. See 5.

This was followed by the vacuum casting in a closed chamber under protective gas. See 6.

The Vacuum and Pressure Casting systems with flask under

HISTORY OF CASTING OVER THE LAST MILLENIA

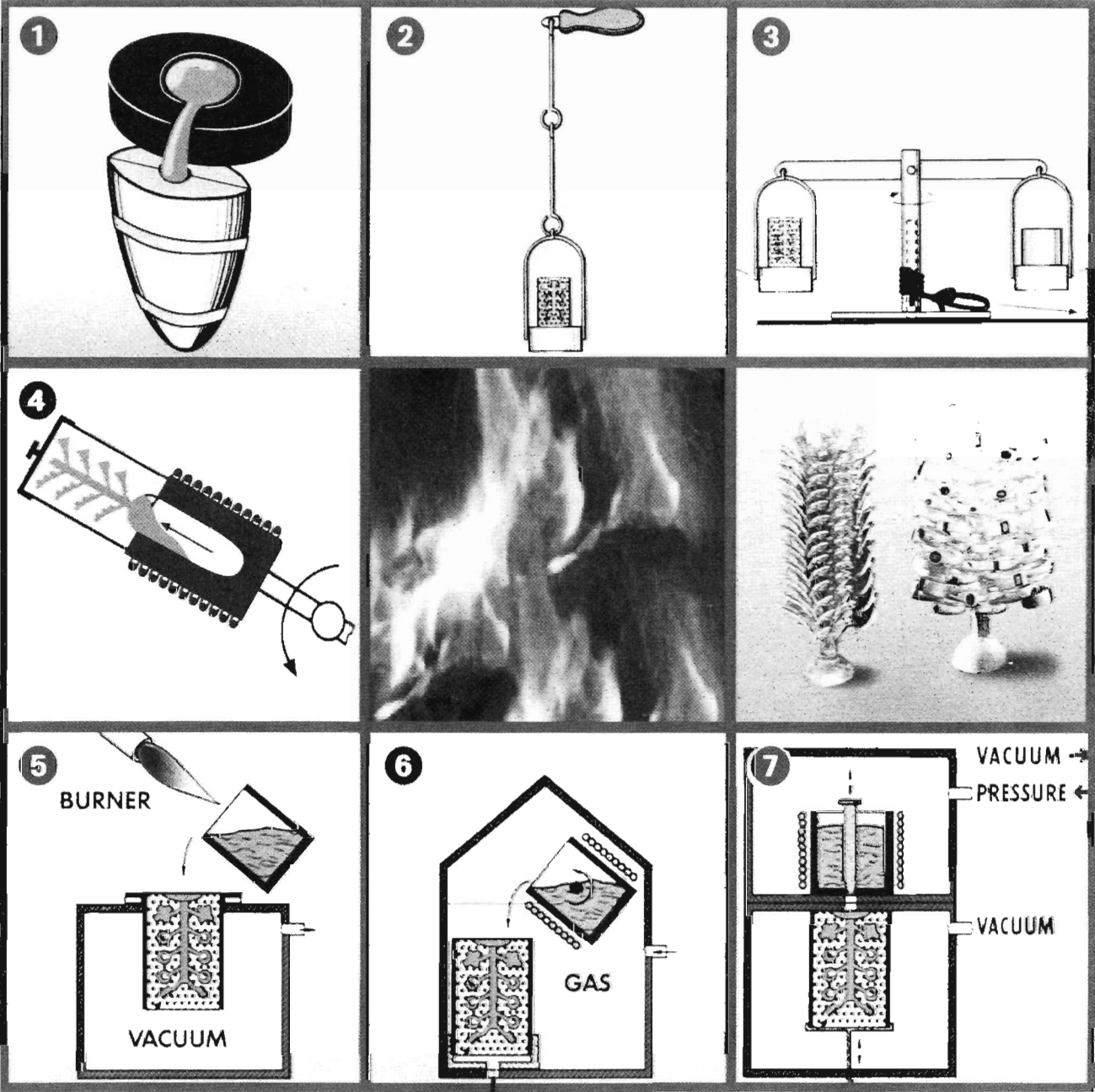


Figure 2

VACUUM

PLATINUM MELTING AND CASTING

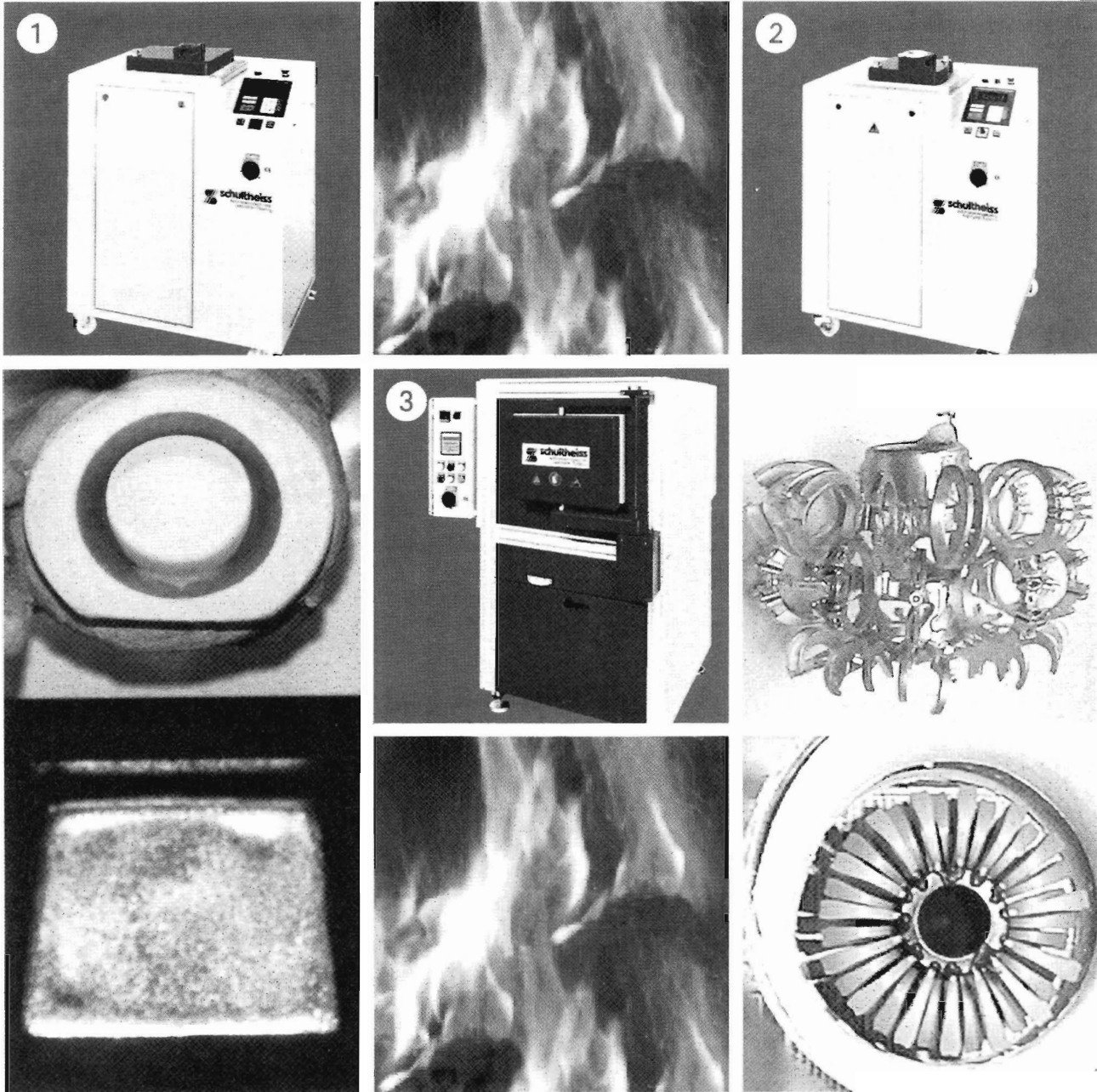


Figure 3

PLATINUM MELTING & CASTING SYSTEM CONCEPT

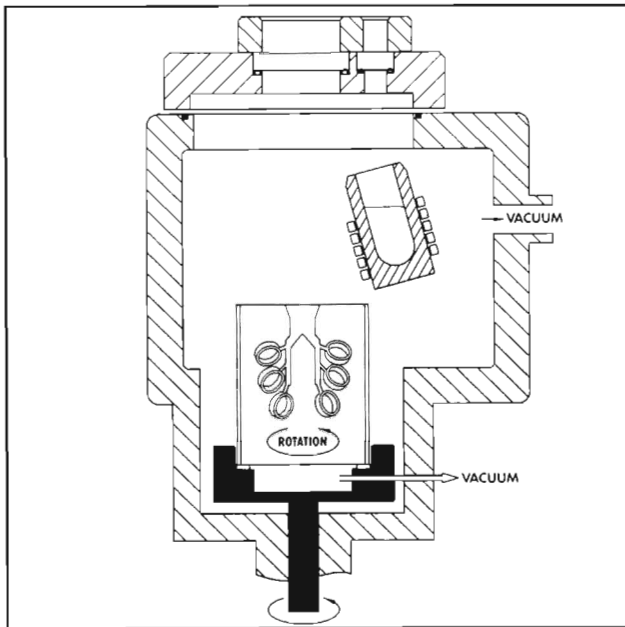


Figure 4

PLATINUM MELTING & CASTING SYSTEM IN CASTING STATE

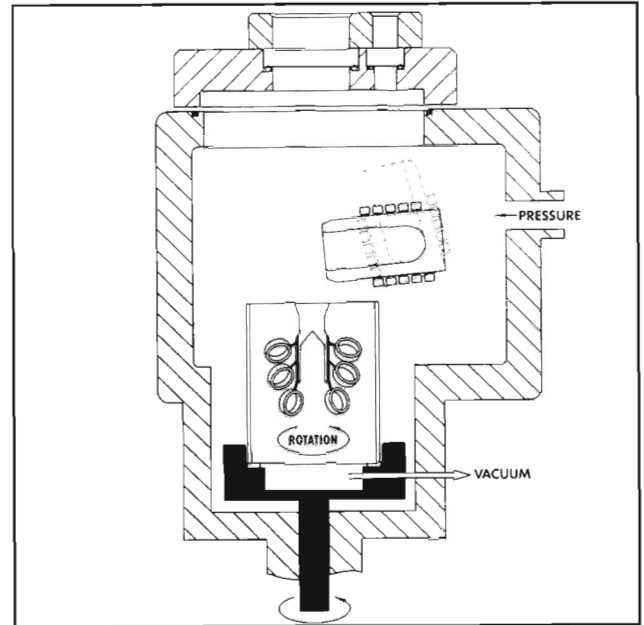


Figure 5

vacuum and alloy under protection gas with over pressure up to (3 bar) 45 psi, vertical casting from crucible bottom direct into the flask, melting by induction heating with powerful mixing of the alloy is the latest step in the gold and silver casting. See 7.

Target (Figure: 3)

Target for our development was and still is to offer solutions for the whole field of casting, even for metals which are difficult to cast, like Platinum, Palladium white gold alloys or stainless steel through units optimized for use.

Demands

We were determined to realize a system which would lead to improved casting results and less defects. A machine that would have more casting force and be able to cast more material. We wanted an optimized proportion

of tree and sprue to useful pieces (up to now best ratio 50 to 50 %) and an economic flask size. Perfect reproduction by unit program memory should be guaranteed and in addition, the unit should be easy to handle, even for untrained workmen.

Solution

As solution we found the casting of platinum under vacuum and pressure is only suitable for heavy parts and for small casting trees.

Melting is possible open - or under vacuum - or protective gas.

The vacuum and pressure casting unit with rotating flasks allows to cast larger trees from filigree up to heavy parts.

The spinning of the flasks in their center axe allows to optimize the usable weight of Platinum to 75 %.

The casting sequence is com-

puter controlled to ensure optimum reproduction.

Program techniques for different metals and sizes of parts are available.

The direct documentation proves the high quality of the products: the system is extremely flexible, as all parameters can be controlled.

The system is open and customer specific software extensions are possible and can be read in by EEPROM or modem.

Diagnose is possible at the unit or via modem.

System concept (Figure 4) (Sectional drawing in melting phase)

The flask and the melting crucible are build into a closed chamber which allows to work either in vacuum or in argon atmosphere with over pressure.

The Platinum is placed in

crucible for melting and the melting is started. The flask is placed on a turntable base with own vacuum connection. The chamber is closed by a cover with window for operator inspection and optical temperature control and regulation.

The Platinum is melted and the spinning of the flask is started.

System concept (Figure 5)
(Sectional drawing in casting phase)

After reaching the casting temperature by unit control:

- The vacuum remains at flask for degassing
- The pressure inside casting chamber goes to set over pressure
- The casting of the Platinum is made by the control
- The speed of flask is set the values set in the program

- The casting sequence is made by the system control which allows 20 casting programs

After end of casting cycle the system opens and the operator takes the flask. The unit is ready for next casting cycle.

This technology leads to improved casting results:

- The vacuum and pressure system with flask spinning leads to *high density* of the cast metal.
- A comparably *low casting temperature* can be used.
- The flask is cast under vacuum for a better *degassing*, thus to produce non-porous pieces with a smooth surface.
- By flask spinning additional *degassing* is very easy to hollow center of tree
- Casting with over pressure is also possible for casting up to 3 bar, 45 psi.

- More *casting force* through rotating flasks!
Common centrifuges
200 mm arm 400 rpm, centrifugal force - 438 m/sec²
PPC about 90m D, centrifugal force - 966 m/sec²

- More *casting weight*, up to now 128-192 dwt; 300 gr.
NEW 700 gr, 448 dwt, 24 oz, 22 troz

- Optimization of the *useful weight proportion* tree and sprues to useful pieces up to now 50% to 50%
NEW 25% to 75%

Up to now 42 flasks ea. 128 dwt - 5384 dwt, tree 2692 dwt, parts 2692 dwt, time - 7 hrs
NEW 8 flasks each 448 dwt - 3589 dwt, tree 896 dwt, parts 2692 dwt, time - 1.2 hrs
1795 dwt less of platinum

PLATINUM MELTING & CASTING FLASK WITH WAX TREE DESIGN

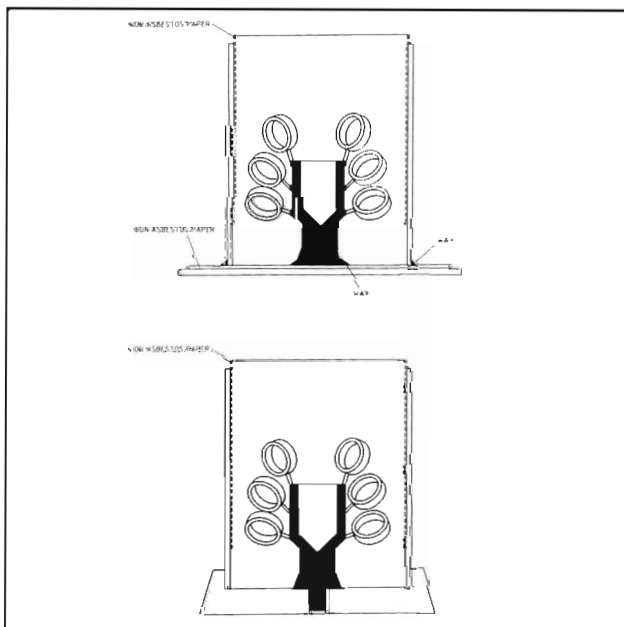


Figure 6

PLATINUM MELTING & CASTING CASTING TRUNKS

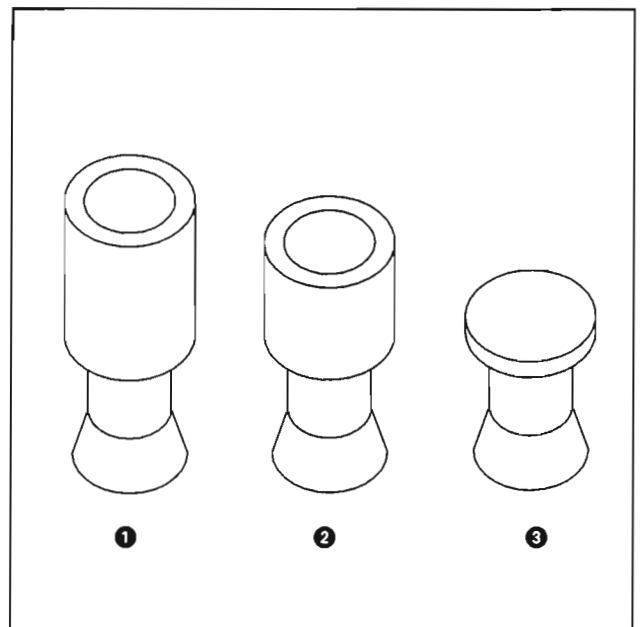


Figure 7

CAST TREES

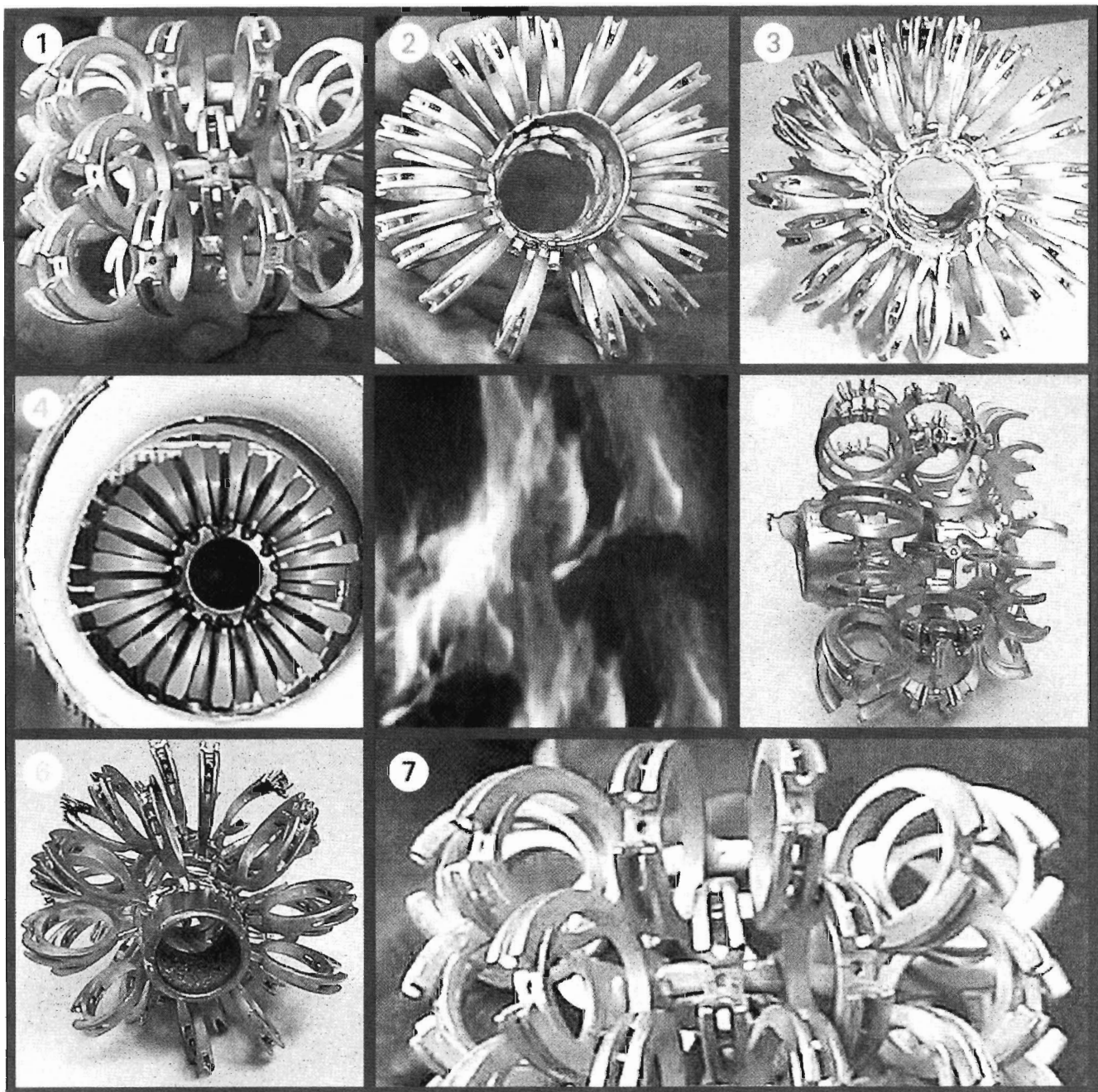


Figure 8

Up to now 42 flasks ca. 200 g
8400 g, tree 4200 g,
parts 4200 g, time 7 hrs
NEW 8 flasks each 700 g
5600 g, tree 1400 g,
parts 4200 g, time 1.2 hrs
2800g less of platinum

Details from one of our customers in US

- *Economic flask size,*
up to now 42 flasks with 6.1 gal
of investment, 3.5' x 3.5',
working hours to prepare??
NEW 8 flasks with 2.4 gal of
investment, 4.3' x 4.7',
working hours to prepare??
- *perfect reproduction* is secured
through computer control with
20 programs in memory
- The unit is easy to handle,
even for untrained workmen

Flask and wax tree design

(Figure 6)

The design of the wax tree is a tube shape. We deliver for the tree rubber molds for easy production of the trees. Depending on the investment used one of the two flask preparing methods have to be used. For sedimentary investment the top side

vestment the top side preparing.

For phosphate bonded investment the bottom preparing is used. We deliver the rubber plate

Casting trees (Figure 7)

Depending on the quantity of the casting parts different length of trees can be used. To achieve a good usage of the Platinum the tube shaped tree can be made hollow to use just ring sections to apply the parts

Cast trees (Figure 8)

I want to thank North American Jewelers INC. Mr. Daniel Coghlan for these pictures.

These pictures show different cast trees as well as a picture of one flask with the wax tree at the inside before (See 4) doing the embedding in the investment.

Conditions for using the PPC unit in the new technology:

To obtain optimum casting results, the new shape of casting tree must be accepted. Moreover, it is important to mix the investment precisely and carefully with distilled water or the prescribed

hardener.

Larger flasks needs accurate investment handling. For some investment we deliver tested mixing and burnout conditions.

The flasks burnt out should be in a furnaces with precise control (Schultheiss has set up special *Flask Burnout Furnace for Platinum* flasks.)

The exact metal weight is necessary (tolerance); up to now large cones were quite common because of tolerances. We offer our customers training for easy start of production. All information of the handling of platinum investment handling should be respected.

I thank Platinum Guild, Jürgen Maerz for the possibility of this presentation and you for your kind attention.

Source: for pictures in figure 6:

Technologiebuch Uhren, Juwelen, Schmuck der Bielefelder Verlagsanstalt Theorie und Praxis des Goldschmieds, Brepohl, Fachbuchverlag Leipzig