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Hooded men in asbestos suits swung a glowing crucible of molten bronze over a huge sand mold. Buried in the sand was a figure of Pegasus, the winged horse, which took six weeks to carve with a grapefruit knife and coarse files from a block of porous, white plastic.

The crucible was tipped and the fiery liquid poured into the mold with an eruption of smoke and blinding light. In 38 seconds the airy plastic was replaced by a 400-pound bronze sculpture. This was the greatest triumph of a new method of art casting which has brought the first real innovation to the ancient craft in 5,000 years.

Duca-sculptures

Alfred M. Duca, a professional artist and research associate in the Department of Metallurgy at the Massachusetts Institute of Technology, has pioneered in the "engineering of art" and perfected a process that may well revolutionize casting of art objects by making it simple and far less costly to carry out. The Pegasus was the most ambitious sculpture he had attempted.

There is no "secret" to the new process--only the adaptation of a material that has been known for many years: foamed polystyrene. This is a light-weight stiff, porous plastic that looks much like

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a block of snow. One of its most common uses is in Christmas decorations. It is made with densities ranging from 1.8 to 6 pounds per cubic foot. A piece the size of a six-foot man, for example, might weigh about five pounds.

Duca, a prominent Boston artist, experimented with polystyrene as a sculpture material 10 years ago and it was then that his interest in it was first aroused. At an exhibition of his sculpture, last year he met Prof. Howard Taylor (who holds the country's first endowed chair in foundry metallurgy). As a result of their mutual interest in reviving art casting, Professor Taylor brought Duca to the M.I.T. staff to do research in casting sculpture. With Professor Taylor's cooperation and support, Duca received a $10,000 grant from the Rockefeller Foundation to study ways in which a revival of interest in casting could be brought about.

He is investigating three approaches: Can the "lost wax" process be adapted to modern casting methods to make it less costly? Can any ways be developed to duplicate existing sculpture readily? And can new techniques be developed that could allow a sculptor to cast more economically? The perfection of the foam vaporization process was an outgrowth of the last of these.

One of the traditional casting processes--the lost wax method which is almost identical to that used in Egypt and China about 5,000 years ago--is done in this way: a model, slightly smaller than the sculpture, is made in plaster. It is then coated with wax and the details of the sculpture are modeled. This might be roughly compared with the way our flesh "molds" our body contours

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on our skeletons. The finished model is then coated with plaster which is dried and hardened. When heat is applied the wax melts and runs off, leaving an exact impression on the plaster -- thus the term " lost wax."

Molten metal is then poured into the mold, filling the space originally occupied by the wax. When the metal has cooled and hardened, the mold is broken apart and the casting is filed and polished. Larger sculptures are done in sections and then the pieces are joined together and finished. Other casting methods being used are even more intricate and time consuming.

The new process, called "foam vaporization," is much simpler to carry out. The statue is carved from a block of polystyrene, using simple tools such as knives and files. The carving is then enclosed in a conventional sand mold, with channels to permit pouring the metal. One of the engineering innovations that makes this process possible is mixing of sodium silicate with the sand. When carbon dioxide gas is pumped through the mold, after it has been packed, it reacts with the chemical, "freezing" and reinforcing the sand. When the metal is poured, the polystyrene vaporizes and a finished casting is produced.

Professor Taylor explained that there are many advantages to the foam vaporization method. "This process provides an extremely versatile medium in which to work," he said,"When modeling is done in clay, mechanical supports are often needed to hold the model together because of its weight and lack of

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rigidity. There is much more structural freedom with polystyrene since such supports are not needed. Statues can be carved and cast that would previously have been impossible.

"The process provides a faithful reproduction of the original shape--in fact, the original shape 'turns into' the casting by being completely replaced by metal. It thus preserves the 'organic vitality' of the work.

"Because of the costs involved, art casting of sculpture has nearly disappeared from the American scene. Sculptured pieces are sent to be cast in Europe, which is expensive and time-consuming. The foam vaporization method is much cheaper and is easily carried out since it can be fitted into existing foundry facilities. The material itself is readily available and is no more expensive than wood.

"Because it simplifies the mechanics of casting, more of the creation of a work of art rests in the hands of the artist. He has more direct control over the outcome and does not have to rely so heavily on craftsmen of various types."

The biggest drawback of the new process is at the same time its most obvious feature--innovation. Since it is a wholly new medium of artistic expression, the serious problem of "acceptance" may be raised by some sculptors.

"Because of the artist-sculptor's built-in love of passive materials such as clay and wax, said Duca,"he will instinctively

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rebel against the use of a new material such as polystyrene. This reaction will probably be much the same as our ancestor artist-sculptor's response to the introduction of granite as a material after wood.

"As tool techniques develop and a greater understanding of its unique advantages are realized, I expect that more and more artists will come to accept this new approach and put it to work."

Duca said that there are several modifications he wants to make in the process: for example, developing a more tactile material so that the artist can model directly with his hands rather than with knives and shapers, and developing a wide range of surface textures. Technical details of the process will be published in the near future.

The most dramatic work that has been made with the process is the 400-pound Pegasus. Other castings that have been made with the new method include a number of minor pieces in ductile iron, the most important of which is a 200-pound piece titled "The Vertebrate." Soon to be cast is a nine-foot "Crucifix" which Duca spent two months carving.

Duca, a graduate of Pratt Institute and the Boston Museum School, has done a large number of paintings, prints, and sculptures and his work has been exhibited in many

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galleries in the United States and in Europe. He is the inventor of a process for the use of polymer tempera, a plastic, in painting and sculpture. Five years ago he began independent research in metal casting, and three years ago had his first one-man show of bronzes, most of which he had cast himself, at the Boris Mirski Gallery in Boston. He has lectured at M.I.T. and Boston University.

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