

Notes on bronze casting, with superficial explanation of some of the technicalities involved, together with bits of history of this ancient art. And, some references to personalities involved.

It is not generally known that when the Grant County Public Utility District undertook to have some art works cast into bronze, the way was prepared to augment the Wanapum Dam Tourist Center with works as individual in their field as the hydro-electric project.

Both are unusual. Both are durable. Each represents an individualism carried out in the only way possible. Practicability. And, meet each problem and resolve it through mature consideration, with employment of best advice and by relying upon the guideposts of experience.

In undertaking this small art project it is again demonstrated what can be accomplished with planning and the imagination to be different, without being impractical.

Persons associated with bronze casting, and they are not numerous, know of no other plant in the west capable of the Lost Wax process for bronzing, other than Picco Industries, ~~Wash.~~ There are a few individual artists, probably all eastern or European trained, who because of necessity have developed their own small melting pots to handle small works, six or eight inches high. And there are a few artists who have developed facilities for occasional pours of individual pieces, then welded together. But the work is so involved they desire to cast only the productions of their own hands.

Picco Industries is located at 1729 North Chico Ave., El Monte, Calif. Lynn A. Smith, the president of this precision casting plant, is also president of the California ~~Amateur~~ Golf Association, a fact that would demonstrate additionally to his executive and administrative ability were references needed.

Some background about the ancient art may provide an expansion of the project beyond that already realized by the PUD. If the quality of the

works is accepted by the public, an unknown element for any artist, the Tourist Center will have wider recognition in compliment to the greater hydro-electric project than can be immediately visualized.

Bronze casting reached its highest perfection in the Cire Perdue or Lost Wax process. Despite its antiquity, it was not until 1900 that the process was practiced in the United States on ^{what} more than amounted to an experimental type of production.

The art was brought to the East Coast by Old World craftsmen who came here with their family secrets, believing the U.S. knowledge of metallurgy and chemistry would aid in perfecting their art. In the Old World heritage of exacting craftsmanship, they were working, always, for perfection.

The art of bronze casting has but recently found its way to the Pacific Coast except for the instance of the rare individual artist. The necessity and uncertainty of having to transport works of art to the east, for casting was a deterrent to works of bronze.

Bronze casting was known before the day of the ancient, Benvenuto Cellini.

These unknown artists built up a core of brick and crushed plaster in the general shape of their subject. They then fashioned wax onto this core, shaping it into the desired form. This was covered with a mixture of clay and plaster. When oven-heated the wax ran out vent holes. The space left was the negative mold.

Molten bronze was poured into this mold.

When cooled, the exterior was broken off and the core picked out. The rough bronze surface, metallic gray in color, could then be surface-chased, patined and polished, all hand work, a practice unchanged to this day.

Only the one figure was produced since the original model WAS LOST and the mold became crumbly when subjected to the heat of molten metal.

Today, the craftsman prepares a negative, a gelatine or plaster mold, depending upon the fragility or complexity of the subject. Details of the

model are reproduced as a negative or in reverse. Wax allows reproduction of the most exact detail and conversion of thin pieces into forms of strength, impossible in plaster or stone.

When a mold has been struck, a wax coating is applied inside it, usually less than one_eighth inch thick. When the coat is built up to the desired thickness the wax replica of the model can be handled, but gently. Knowledge of the wax, its melting, hardening and other characteristics must be known by the artist, who usually develops his own type of wax, adapted to his own craftsmanship.

It is this hollow wax form which the artist touches up. He can, with proper tools, bring out rare effects of detail or make final corrections which become obvious at this stage. Not infrequently the artist spends as much or more time on the wax than the original model, although this depends upon whether he intends to do some work on the wax at the time the casting is commenced.

When the wax model is complete to the satisfaction of the artist the piece is gated, preparatory to investing.

Rods and gates, reclaimed wax processed to dimensions, are attached for gates. A nearly clear type of micro-crystalline wax is used to make the binds. These must be placed at proper places on the shell, so the pouring can be accomplished without difficulty.

A simple work can be bronzed in one pour or piece. But a more complex work must be cut into sections at the proper stage of casting or waxing.

When a complex figure is cut or sectionized, Roman Joints are made by the caster to insure the proper re-assembly of the cast. Extremely complex figures and pieces are cast separately and poured separately, and reassembled at the welding stage of the process.

Investment of the piece is the term used for preparing the wax for pouring the molten metal.

Two or three artists are required to "invest" each piece, depending upon its size, shape and other factors.

Each piece or section is dipped into a creamy-like formula, then covered with a special kind of "sand". The piece is left to dry and then the investment process is repeated at least 10 times, on various days. This part of the process cannot be rushed, except through use of controlled atmospheric conditions and other aides and this is not always satisfactory since they set up conditions which could encourage the damaging of the work.

The investment solution can resist temperatures of at least 2,300 degrees fh.

When the mold has been invested sufficiently and seasoned properly, it is oven heated at low temperature and the wax shell inside is melted out and is "lost." This process leaves a thin, hollow space inside the investment mold .

When the mold is properly positioned for a proper flow of metal to the various recesses inside, molten bronze is poured through a key gate from which the wax has been melted. Proper balance, judgment for location of this pour hole and other knowledge is necessary to insure a clean pour.

Cooling does not take long and the bronze cast is removed, looking far from a work of art. The investment coating cracks or crumbles easily at this stage. The cast has the appearance of dark iron.

The piece is then sandblasted to remove clinging bits of the investment shell. This is followed by chasing with special metal working tools. The piece is placed in a sand-filled chasing box, so delicate delinations will not be damaged. The blows of the chaser, must be proper, and this comes with long training.

When the chasing, and as necessary the burnishing is completed, the piece is ready for assembly, if piece cast, through welding. Seams are carefully obliterated by the chasing hammer and chisel.

From the acceptance of a work into the foundry, the piece is evaluated and carefully studied so that insectionizing a work seams are not left where their healing will be noticeable.

The finishing or patina depends upon the additional skill of the craftsman who uses a bunson burner type of blow torch, heating the bronze metal to a proper "absorption" temperature. The craftsman must know at what stage to relax the heat, brush on acids, or wash and stipple with cold water and brush to insure against a too thick application. Coloration is checked must^{C+} in the manner metal is tempered.

Sulphur, iron, copper, nitrate and coppersulfate are applied at 400 degrees. Nitrate provides a near apple green, brown-black a darker green. All are sulfides and can provide thousands of tones depending upon their usage, heat, length of heat, "tempering," and the craftsmanship of the artist.

Variations of apple green, not too light and not too dark to be drab and somber have been chosen for the patina of works in progress.

The fountain shade will vary from the figures and heads.

The fountain centerpiece will weigh an estimated 250 to 350 pounds. Exact measurements were not computed because of the spiral form, the non-cylindrical shape of the core, and protruding roughness on the core. There are nine fish, each approximately 17 inches long. Each was built on a separate armature to save extra clay and when they were removed for transportation, each weighed exactly four pounds. Each fish is different. Uniformity, which would have facilitated casting would have made the work mechanical in appearance.

The bronze department craftsman will design an inch and one-half copper tubing tree for inside the centerpiece. There will be a summit outlet for a mushroom type emission and two lower outlets fitted with 3/4 inch orifices at the fountain site.

All of the pieces will be hollow cast. Only the feet and parts of the legs of the figurines will be solid.

Puck-Hyah_oot 's head, a full bust, should not weigh more than 65 or 70 pounds.

All pieces, the craftsman and others at the studio concur, should be mounted. Natural stone, tool marked bases will be used for this finishing work unless their display situation calls for another treatment. The pieces will be fitted with an anchor bolt and a stop bolt. Studio fitting of the pieces would cost from \$50 upwards to several hundreds of dollars, depending upon the type of material used. (Picco does not do this type of work, which would have to be farmed out, so they will be returned and fitted upon return. Type of fittings etc. will be governed to some extent by their display).

All metal casting shrinks about 1/16th of an inch to each foot.

Bronze is an alloy of copper, tin and zinc. Only small pieces can be cast solid. Larger pieces would warp or split with the contraction of cooling.

Iron is malleable by anvil and heat. A fractional addition of carbon added to iron converts it into steel.

Art bronze for casting is commonly called 90-3-7. This is 90 per cent copper, 3 per cent tin and 7 per cent zinc.

This mixture liquifies at 1,750 degrees and is poured at 2,100 to 2,200 degrees. Steel is poured at 2,600 degrees.

Even in the 1940s a 15-inch figure, plain, without cuts and welding, would cost \$150 for the casting alone and extra for chasing and patina. Piece casting, cuts and welding would have doubled the price.

People of the Agean learned to use bronze in the second half of the third millennium B.C. and the art was lost during the Dark Ages. The Greeks re-discovered the art from Cyprus, Phoenicia and Egypt.

The origin of hollow casting is obscure, but was known by the middle of the 7th Century, B.C.

Bronze had a role in the culture of man.

First, there was the Stone Age.

Supplemented by man's progress this developed into the discovery of bronze and his utilization of it for weapons and religious and ceremonial objects. Bronze weapons and figures gradually replaced stone, depending upon the advancement of man in a specific area. This did not take place throughout the world at a given time, because even now there exists regions where Stone Age and Bronze age culture yet endure.

The Iron Age has followed throughout the civilized world.

Bronze work became a hereditary skill through the pre-history era of man.

Copper was used in Egypt a thousand years before it was known to Central and Western Europe. It was smelted in Crete and Cyprus at least 3,000 B.C. and bronze a little later. Since tin is an essential ingredient of bronze the use was not widespread because of the rarity of large supplies of tin.

The Iron Age arrived 1000 to 900 B.C. This more common and abundant metal replaced the common use of bronze. But bronze, because of its beauty, durability and craftsmanship involved, including traditions, was retained for making religious and ceremonial objects and consequently for sculpture.

So today, the Bronze Age of art, after experiencing its beginnings in the New World, first in the East, has advanced westwardly to the Pacific Coast. An example is being prepared for the Wanapum Dam Tourist Center. Suitable additions, from time to time would be another way of making the Center outstanding and different from any other.

The manufacture of bronze, like that of iron, was unknown to the Indians of the Northwest, and to the Wanapum band, who in reality emerged from the Stone Age directly into the Iron Age, when they were visited by explorers and traders.

The desirable objects of metal which the traders brought, introduced a new culture.

The indigneous art of bronze work, so highly developed and so long perpetuated in Italy-- although Venice had to go to Constantinople for the bronze gates of St. Mark's Cathedral and Rome was compelled to acknowledge Byzantine supremacy in the bronze gates of St. Paolo in Germany--was advanced by the craftsmen of Nuremberg, for a time a center of art culture.

German foundries in the 12th century were pouring fonts and Cathedral doors for most of Europe.

There was one bronze worker of Nuremberg of special interest in history, yet little known by name although his works, now in museums, are highly valuable.

He was called Peter Vischer, the grandson of Hermann Vischer, and his mark was two fishes. He is important because he embodies the ^{transition} ~~transition~~ from the Gothic to the Renaissance style in Germany.

There is something which must be akin to the atmosphere of the old bronze foundry, now re-born in the Picco Art Department. This extends far back to the days when the leather apron was a sign of the trade. These modern artists at Picco wear canvas aprons. It was a compliment when one was offered to me at the foundry.

There was a time, in the flowering of this art of bronze casting, when every trade had its special costume of distinction. These were the guild days, when wages and holidays and the amount of work done were fixed by the Guilds. Boundaries were laid down between trades in the Middle Ages and no worker crossed them.

Among the bronze workers it was customary that ~~when~~ the trade remained in the family through generations. In this way new discoveries or secrets were added; new abilities and processes were developed.

It was also the custom that after an apprenticeship had been served the worker would go on a journey. This was called his Wanderjahre in German.

The journey, which sometimes lasted for years, enabled the artist to draw experience and inspiration for his later periods of productivity.

(My journey to Picco was such an experience, in a very small way).

Hermann Vischer's eldest son, Peter, made a journey. He went to Rome and returned with drawings and ideas.

So it happened the Vischer family of bronze workers gave themselves to the worship of the beauty found in a new form, and the eager copying of the antique. And so Peter Vischer finished his life by adopting new ideas of a more delicate Italian art, discarding traditions in which he had been reared.

The full beauty of fountains in various forms was at its greatest in Italy and there were craftsmen expert in fountain designs and in making medallions. This kind of work infused the blood of later generations.

Peter Vischer was admitted as a Master of his Guild in 1489, the highest distinction a living artist could attain.

If the Guild existed today, rather than in those few who follow its strict discipline of craftsmanship, Cataldo T. Papaleo, called simply craftsman at Picco, would be recognized as a Master Craftsman.

These artisans had a joy in their creations, contrasted with a tradesman's small delight in a commission. They had deepened their powers of sympathetic imagination. This was inherited from a time when religious emotion was afoot in the world. Any work inferior to the best was intolerable.

Papaleo, the master craftsman, comes to the bronze art department three days a week presumably to supervise the work and take care of special casting and finishing. But he is always at "work."

He comes from a family of artists, and came to the Pacific Coast to retire, and recover from a severe heart attack. But driven by his feeling for the creative, he refuses to retire.

He attended Cooper's Union at New York and won a three_year art scholarship to Harvard by sculpturing Milton, the Blind Poet. This work is now at Milton, Mass.

Papaleo's "master" at Harvard was Dr. ^{WILSON} Wilson, who taught "anatomy, anatomy, and anatomy" as the foundation on which art is built.

Papaleo has been an active and prolific creator, exhibitor and bronze caster and instructor. A list of commissions he has completed would be long. A few are Library of Congress, Smithsonian Institution, Arlington Cemetery, Veterans Administration, the late President Kennedy, Admiral Forrestal and Admiral Nimitz trophies, St. Patrick's Cathedral, Temple Emanuel, commissions in the west; and his work is in the collections of the Kennedy family, Pope John VII, the Vatican, S.F. University Library, and Lincoln Memorial Library.

He has completed nine medallions of the 21 California missions. The final medallion in the set will not be finished until 1970.

The wax for each medallion is nine inches across and there are two sides, one the obverse and the other the adverse, both sculptured. The San Gabriel Mission medallion, for instance, reproduces the Indian mural ^{OF THE 7TH} ~~in the mural which~~ ^{STATION OF THE CROSS} which contains many Indian and missionary figures. ?

A plaster cast is struck from the wax model. This is converted or reduced to a 1 ~~1~~ 5/8 inch coin quality medallion from which a die is made. The cost up to this stage is \$800 to \$1,200. Once a die is made, medallions of pure silver or bronze may be struck from the die, year after year, at a cost of from \$3.50 upwards to \$20, depending upon the kind of metal used. Gold would be more expensive.

Branches of government, institutions and companies use medallions for presentation for high awards of significant anniversaries, furthering long held traditions. And there exist medallion societies with large memberships of collectors, museums and libraries/

The die from which the medallion Lewis and Clark brought on their explorations and distributed to Indian chiefs yet exists and copies of this may yet be procured.

When Papaleo sculpts a figure he completes the work in the nude first,

then, according to the subject, thin-covers it with clay, the clothing.

"When you build a house," he said, "you have to build a frame before putting on the siding and shingles."

It was this procedure which was followed in the "Fish Ladder," the "Ladder of Life," showing salmon ascending a waterfall on their migration to the salmon spawning beds, their place of birth where they return through some explainable, relentless urge from the sea. There they spawn and die, completing a life cycle and the fingerlings find their way down the Columbia to the sea until they too mature.

This will be some of the theme material included in material to be sent later. This is because that despite the fact that salmon have been this state's greatest industry in the past, have subsisted untold generations of men and then pioneers to this state, no one has "memorialized" them in any work of art to my knowledge in this state (or elsewhere); And this will permit the inclusion of material showing to what extent the PUD has gone to provide fish ladders, spawning beds etc. to help perpetuate salmon, not only for sports fishermen but for the industry yet remaining.

Each of the nine salmon on the fountain center piece was treated to give the effect of the fish, ^{Species} each was built on a "flexible" armature; each was built from the foundation up and then "the clothes were put on."

Besides three days a week at Picco Papaleo teaches art professors at Riverside College the techniques of sculpture and sculptural materials. This he does in his efforts to help train sculptors to work toward pieces that can be cast most economically, without sacrifice to good art; the most economical materials to work in; how the best effects ~~and~~ can be achieved and how the art can be properly utilized.

There are many pieces of art brought to the caster to be converted into materials unsuitable for their utilization. There are some pieces brought in by students unsuitable to be cast in "enduring" bronze. And he will not accept some pieces for casting for reasons that are

for the best interest of the artist, or for some company or institution.

One reason, could be, the historic fact that many bronzes have been known to outlive the project for which they were created and were re-set for use in a building they outlasted. And it is conceivable that would be the future of the fish fountain "The Ladder of Life." It is conceivable, too, that the fountain centerpiece will "live" after the fish disappear from the river; and that the Indians will "live" after there are no more long braids and no more full blooded Indians, as we know them, this generation.

Lynn A. Smith, the Picco president also has ~~an~~ a knowledge of art recognizably superior to that of someone we commonly think of as a company president. He appreciates art, utilizes it himself and without his appreciation of works of art it is doubtful if the Classic Art Department of the foundry would have been established, because that is not the principal output of Picco Industries. It is not a sideline, either, nor is it a hobby, but a well-conceived and sincere endeavor to produce good works of art for good art.

Papaleo comes to the studio early and demonstrates an acute ability to organize production, keeping various pieces moving through the individual processes with expediency of timing, utilization of his artists' time and talents and foundry facilities.

This was evident when I was at the foundry and for this reason, among many other factors, was it possible to obtain the more than reasonable rates and price for the works ~~in~~ in progress. Volume is essential for any economical production, especially when hand work, piece by piece is required.

In various stages of production, receiving attention of various artists were many pieces, including work by the head of a sculpturing department of the largest university in California and several small pieces by Albert Stewart of California who has more than 50 architectural

sculptures in civic, commercial and church buildings in major cities, including heroid size terra-cotta figures for the Los Angeles Court House. (Picco does not fire terra@cotta).

One of the several art rooms in the Classic Bronze Department at Picco is where dedication and plaques with "ready set" letters and simple borders are made up.

I saw the finishing work being done on one such plaque for a large hotel at Las Vegas, and several smaller ones being produced for schools and institutions in California, and the quality was excellent.

To provide a general basis for any dedication plaque the PUD might have in mind at some future time, I obtained the following information:

An approximate 20 x 30 inch plaque, with the proper or suitable oval face letters, and containing approximately 400 letters could be produced for a minimum of \$300 and the maximum would probably not exceed that by say up to \$50.

When text is submitted a drawing is provided within a few weeks, dependant upon mail service. When approval of the drawing or sketch is received the plaque can be produced in a minimum of 30 days. It is delivered, less carriage, fitted for mounting.

Estimated Production Schedule

I obtained the estimated production schedule and we will be notified from time to time of the status of the work. I will be called direct by a responsible representative of the firm in event some difficulty is encountered or some question is to be answered, and depending upon the matter will tell how it is to be handled (if related to the work) and consult the PUD, (if related to the purchase order).

Molds were started on the clay works Oct. 4. This will be followed by agar molds for the plasters.

The waxes will be completed the first week in December. (This is the type of work, as explained, the artist does. It is his final

opportunity to make corrections , such as detail in fingers, toes etc. on the small figures, easily done in wax contrasted on the original model. And you will recall that both of these were rushed through pretty fast, much more so than is normally the case where several months are required on such figures. Some allowance has been made for the studio artists, like Papaleo to re-touch the waxes and this may be the one place the firm has "underestimated."

This type of work is not a mechanical process. But if some extra work beyond expectations is advisable, we will be notified. It should not be much and may be nothing.

I do know that through my own error I did not request an estimate for six name plates, the four heads and two figurines. And it was not until my last afternoon at the foundry, on my final check to see everything was ok, did this come up. I have ^{asked for} ~~authorized~~ name plates, which I will attach to the works, or in proximity to them. ^{when display location is determined} They will be small bronze plates, individual, with 1-Puck-Hyah-oot; 2-Alice Slim Jim Charley, 3-Chief Kuni or Tommy Thompson ; 4, Medicine Singer; The Last Drummer and The Fisherman.

It dawned on me, suddenly, that it would be a frequent question of visitors; "Who is that?" or "What is the name of that?"

There was no one in authority at the studio on that late occasion who could give a specific estimate, but those familiar with such work said the charges were very nominal, so I trust that this can be attended to on a voucher at the proper time.

After the waxes are completed and Papaleo has approved them this will be followed by the investing and gating.

The castings will be made by late January and then they will be ready for assembly, welding of the arms on the drummer, fisherman, spear, drum, Puck-Hyah-oot 's upraised hand, and parts of the fountain centerpiece etc.

The Patina will be applied in late January or early February.

15 (Remember, Papaleo has always advised that better work can be done if as much time as possible is permitted before delivery)

Like some of the casting, re-touching, etc. this is work that Papaleo will do. He said it would take four or five days for the patina.

How does he go about his work? Some observations will give a slight insight :

With glasses raised high on his forehead, he walks about rapidly in soft soled shoes. When he talks, he sometimes twists his mouth for emphasis, and there is no doubt about the points he emphasizes. He moves here and there about the large studio and the smaller ones. Pausing at times he sizes up the subject and the project involved, working out the problem in his mind and then setting to work on it or putting the artists at work according to their specific talents and abilities.

Papaleo realizes he can never be content until he can be an old master. And about that , he said:

"I know I never can."

He yearns to find time to make decorated goblets of gold and silver, hand hammered work, an art form in which he has produced works for collectors, the best jewelers, and others.

A buzzer-bell signals a short lunch break or time for breakfast, the arrival of a small specially fitted truck operated by a caterer, one of several making the rounds of the industrial section. The mobile cafeteria dispenses ready-made sandwiches, soft drinks, coffee, pastries, etc. Sometimes the art staff members bring their own lunches, and sometimes they patronize the caterer.

Papaleo usually scrambles eggs for his lunch, using a stove on which a ~~large~~ large coffee pot is always ready.

The art department staff gathers on an assortment of old chairs and an old davenport around a table to eat and talk in the short time they take out. They talk about art works, discuss pictures in art books, report on weekend activities, music concerts and personal projects at home.

They are willing to share their advice in fields in which they are most talented with less expert in certain skills. And Papaleo is always willing to clear up any points or to inject some appropriate remarks toward their training, and they are eager, absorptive listeners. Then back to work.

Patina on one object, wax on another, this one ready for the investment.

And a final round of the PUB works in progress, a final briefing and checking over:

"Get shims, about 40 feet will do for the fountain" he said to two of his helpers.

"Remember not to set them where I cannot reach later with the patina... cast the fountain in rubber. Have you ordered it?

(The supply house is not far distant and large stocks of supplies are not stored. Some materials, because of their chemical composition cannot be kept overlong. "You know casting plaster shell kills?")

"Now, this fish..." and he demonstrated how to remove one from the centerpiece..."see this thin fin. You will cast it like this. Press it close to the fish, so. Then when it is in wax you lift the fin to its original position, like this..."

(This was a concise and clear demonstration ~~in~~ of the advantages of wax, and how it is possible to cast seemingly impossible figures. Take an orchid, for instance. I saw a bronze cast of one. It was done somewhat in that manner. The petals, which were so thin they must have compressed when they were waxed, could be lifted to their original position when the wax hardened. The fin, protruding from the fish's side, on the clay model, was pressed down, against the fish. When the wax is made, the fin will be lifted to its original position! Then the investing, the making of the negative into which the bronze is poured, follows normally).

"Don't make any of the cuts the same when you remove the fish for casting. Be sure they are all different so they will set back only in the one place."

He stepped back from the fountain, studying it again from all quarters and at several distances. Then he enlarged upon an earlier observation.

"The bottom of the fountain should be at least 18 to 24 inches higher than the floor, or even higher. It should be high enough so one has to look up to it. Fountains should be that way. It seems large in here but put it outdoors and it will be smaller. And if there is one side on which people pass more frequently than the other, this side should face them. You see all the fish better from here, just a little better..."

About metal.

"You don't take scrap metal and throw it into a melting pot. When you take bronze scrap metal to the smelter, the smelter asks you the type and then puts all of the same type on a pile. The smelter melts it and removes the dross. Then to be sure the ingots are ⁹⁰⁻³⁻⁷⁸³ ~~97-3~~ a chemical test is made of each ingot. Otherwise some metal will break down. It won't mix with the rest. The results could show anywhere in the cast and weeks of work would be wasted."

And so the Bronze Age is finally coming to the country that was, such a short time ago, Indian country. Here the explorer came, bringing the culture of the Iron Age.

Thus in one long step of a comparative few years the Indians advanced from the Stone Age across the Bronze Age to the culture of Iron, hydroelectrics and atomic energy.

But the religious culture of these people is stronger and longer enduring than stone, bronze and iron. It is unchanged except for some tempering by the heat of a later-age culture.

These Indians and salmon might be called blood brothers because the urge for survival is still so strong within them.