April 27, 1965 J. G. MAST 3,179,988

MATRIX FOR PRODUCING PRINTING SLUGS AND PROCESS FOR MAKING THE MATRIX

Filed May 8, 1962 2 Sheets-Sheet 1

Fig. 1

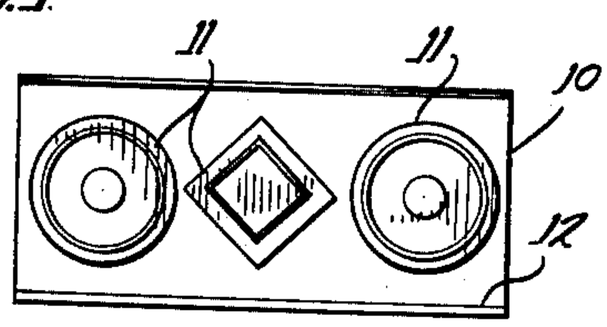



Fig. 2

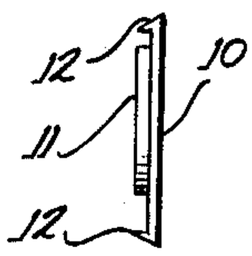



Fig. 3

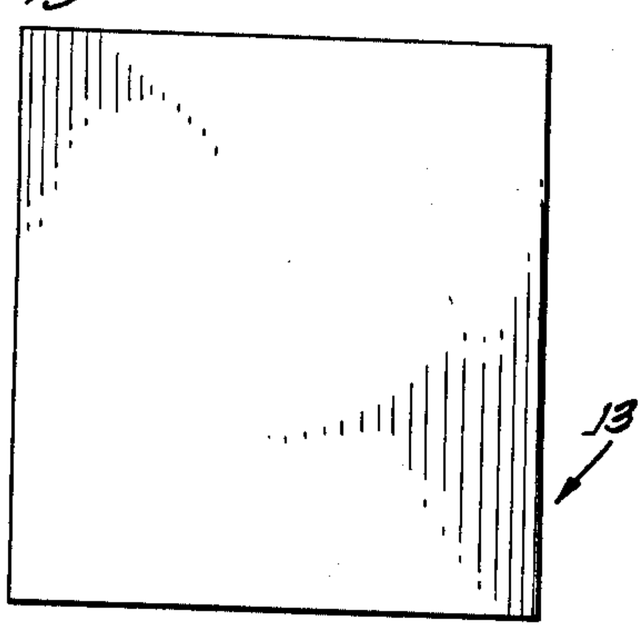



Fig. 4

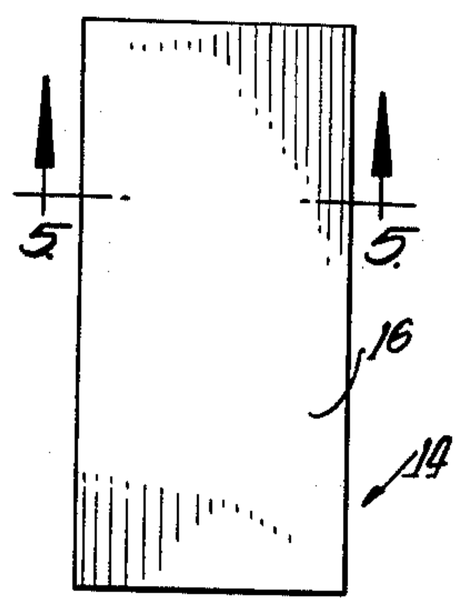



Fig. 5.

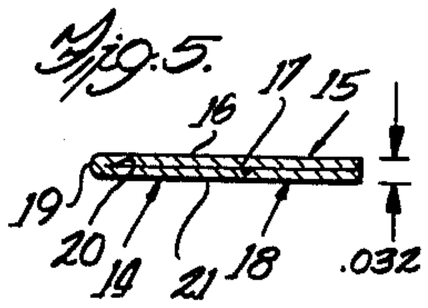



Fig. 6.

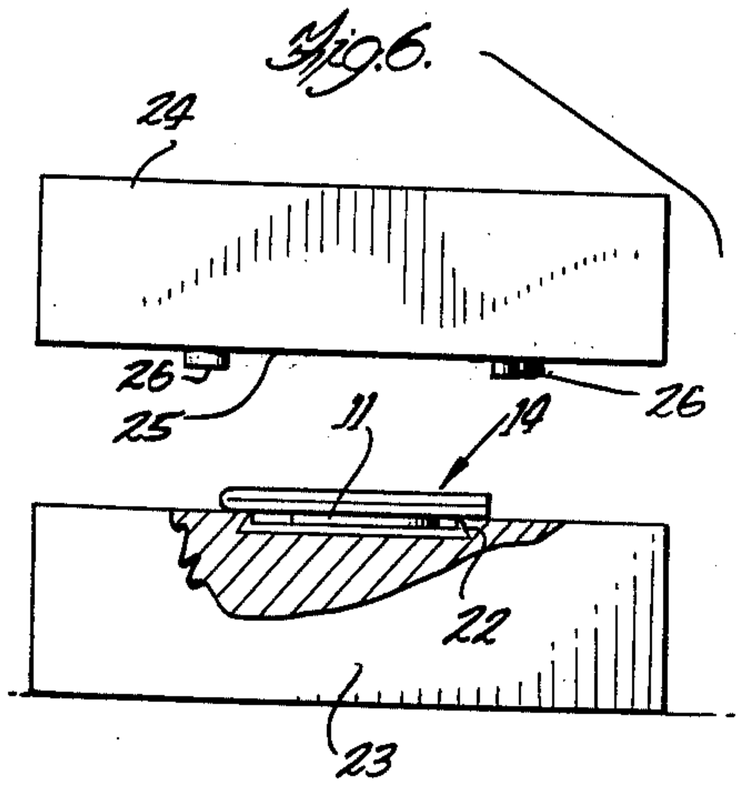
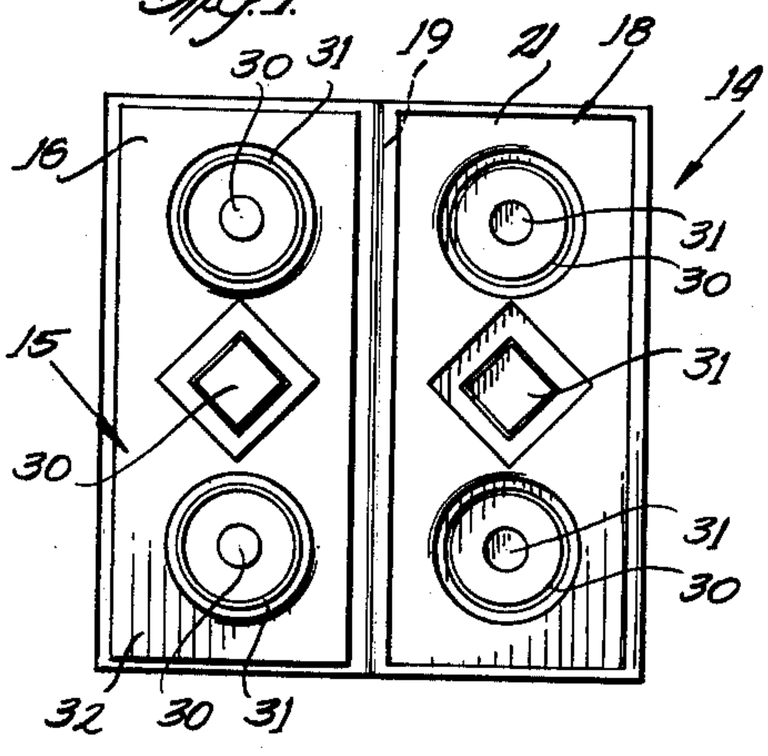



Fig. 7.

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MATRIX FOR PRODUCING PRINTING SLUGS AND PROCESS FOR MAKING THE MATRIX

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Fig. 8.

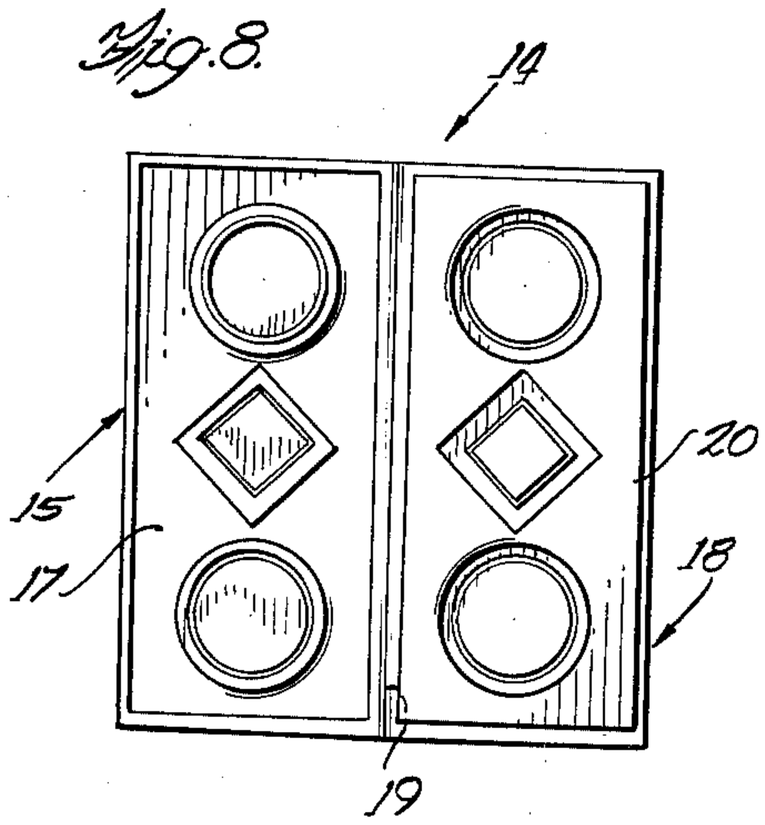



Fig. 9.

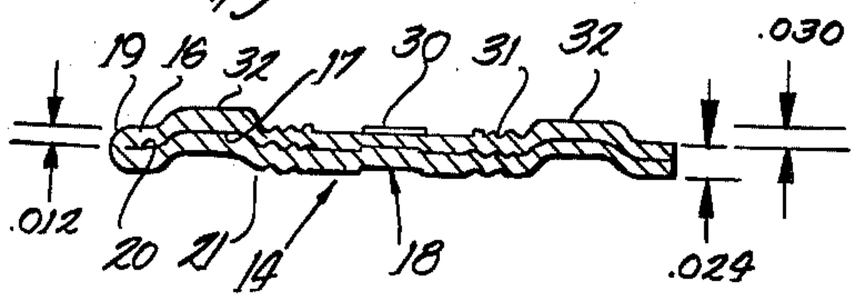



Fig. 10.

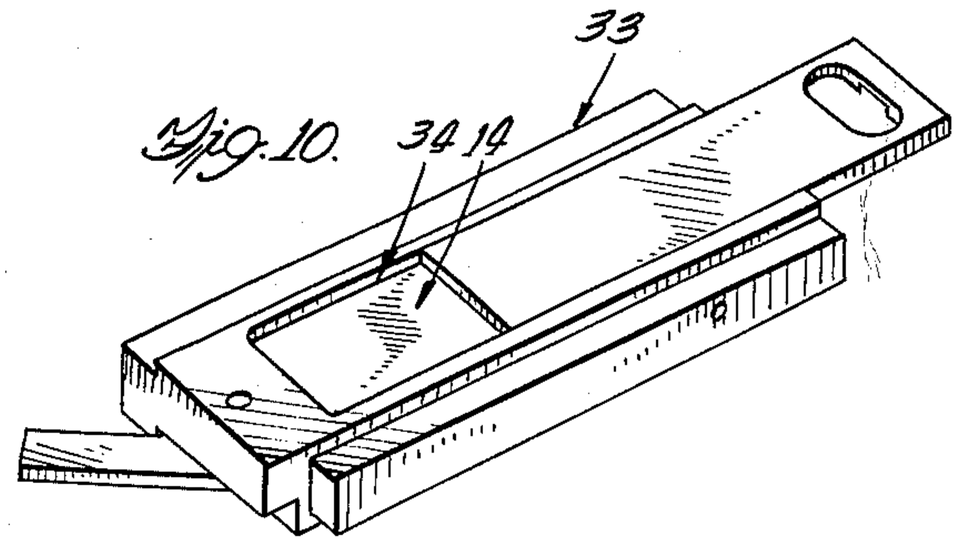



Fig. 11.

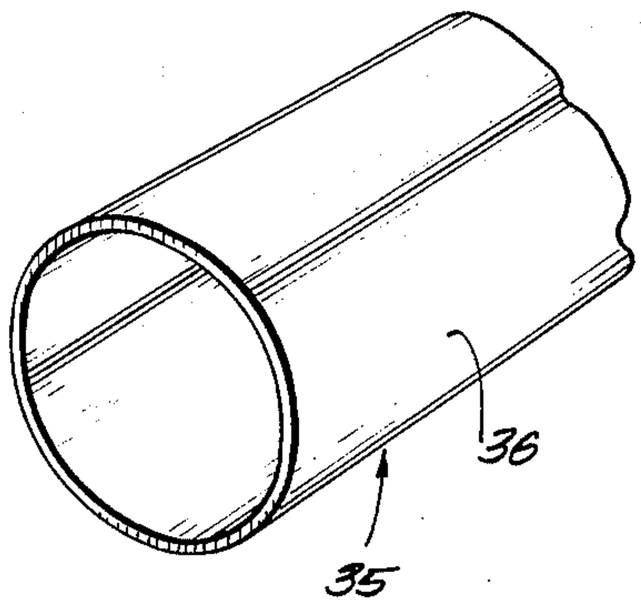
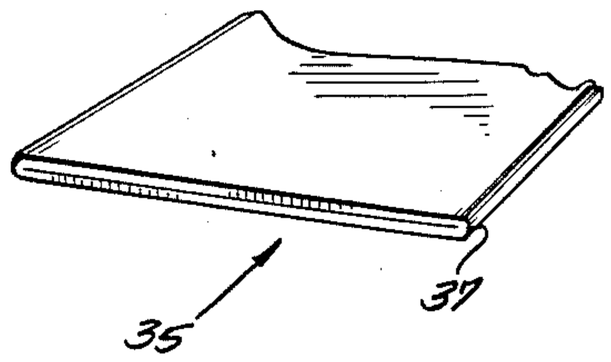



Fig. 12.

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United States Patent Office

3,179,988

Patented Apr. 27, 1965



# 3,179,988
# MATRIX FOR PRODUCING PRINTING SLUGS AND PROCESS FOR MAKING THE MATRIX

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Filed May 8, 1962, Ser. No. 193,235
11 Claims. (Cl. 22—5.5)

This invention relates to an improved matrix of a type used in the printing industry. More particularly it relates to an improved matrix and to a process of producing matrices for producing printing slugs.

The most widely used and conventional type matrix is generally made of porous paper and after it has been suitably impressed by high pressures with the detail of an engraving, it is placed in a holder or stick whereupon lead under pressure is poured into the matrix and the printing slug or plate is thus obtained. Such matrices, or as they are known in the art, "mats," have distinct disadvantages in that they deteriorate rapidly and can only be used for one casting. Also they readily absorb moisture and therefore are unstable as to size because of expansion and shrinkage. Different mats have been tried wherein a thin foil of metal would be bonded to a backing plate of fibrous material. Such a construction was found unsatisfactory since the foil could not withstand the high pressures of forming in the process of impressing the engraving and thus tearing and destruction would ensue. Many other variations have been tried without success. Another distinct disadvantage with paper matrices was the fracture of the paper fibers during the embossing which caused the ends of the fibers to form pit marks in the slugs which were produced from the paper matrix.

It is therefore a prime object of this invention to provide an improved matrix which can be used over and over again and which will continue to withstand the high pressures of lead pouring.

It is another object of this invention to produce a matrix which will not absorb moisture, which will not be porous and which will not shrink or expand to any substantial degree.

It is a further object to produce a matrix from a soft metal, the metal being sufficiently strong to withstand high pressures of pouring, and high heat, and being so disposed as to be readily impressed under high pressures with the detail of a steel photo-engraving plate disposed in a punch press or roller press.

Still another object of the invention is to provide a matrix that can be inexpensively produced in a high pressure press operation.

Another object is to provide an improved matrix consisting of two layers of identical material of certain dimensions, one layer providing the pattern surface, the other layer providing the backing or control surface during the impression of the pattern surface by a steel photo-engraving by means of high pressures.

A further object is to provide an improved process of producing a matrix including the steps of using the same in the formation of a cast printing plate or slug.

Another object is to provide an improved matrix formed of very soft substantially pure aluminum having sufficient ductility and tensile strength to be impressed with an embossing die under high pressures resulting in a strong durable, non-porous matrix having substantially perfect detail.

Another more specific object is to provide an improved matrix and process of manufacture where the matrix consists of a flattened tube just prior to the impressing operation.

These and further objects will become more readily apparent from a reading of the specification when examined in connection with the accompanying sheet of drawing, in which:



FIGURE 1 is a plan view of a steel photo-engraving having a certain detail;

FIGURE 2 is an end view of the photo-engraving of FIGURE 1;

FIGURE 3 is a plan view of a blank of aluminum sheet used in making an improved matrix;

FIGURE 4 is a plan view showing the blank of FIGURE 1 folded to provide two laminations or contiguous layers connected together at the folded edge;

FIGURE 5 is cross-sectional view taken along the line **5—5** of FIGURE 4;

FIGURE 6 is a side elevational view of a folded matrix blank in position in a punch press with the blank disposed on top of a photo-engraving ready for the impression or forming operation;

FIGURE 7 is a plan view of the folded blank, in an unfolded position showing the pattern or detail side and the bottom or backing side after impressing operation;

FIGURE 8 is a plan view of the blank which has been impressed in an unfolded position showing the underneath side of the pattern surface and the normally contiguous side of the backing layer or lamination;

FIGURE 9 is a cross-sectional view through a matrix, after it has been impressed showing the raised and compressed portions providing the desired detail;

FIGURE 10 is a perspective view showing the matrix seated within a stick, which in turn is utilized in a machine (not shown) for producing cast printing slugs;

FIGURE 11 is a modification which shows a perspective of an aluminum tube which may be of the same length as the desired matrix; and

FIGURE 12 is a perspective view which shows the aluminum tube of FIGURE 11 flattened to provide a blank for forming a matrix.

Referring now to the drawing, FIGURE 1 shows a photo-engraving **10** which is constructed of steel. The engraving **10** comprises a thin steel plate having suitable projections **11** forming the desired detail. The edges **12** of the engraving are tapered. In FIGURE 3, a blank of flat sheet aluminum is designated at **13** the thickness of which is .016 of an inch. The material found to be most desirable is substantially 99% aluminum with remainder impurities. The aluminum sheet used has been annealed after it has been produced to make it exceptionally soft. It thus has a softness designation known in the aluminum trade as "0." This designation is found in the book known as "Sheet and Plate" product information second edition, January 1958, copyrighted by Kaiser Aluminum & Chemical Sales, Inc. The designation in the trade of this substantially pure aluminum is 1100, and is known as being relatively soft and ductile. This material has a tensile strength of 13,000 p.s.i., and yield strength of 5,000 p.s.i.

FIGURE 4 shows the aluminum sheet **13** folded into two substantially identical layers providing a matrix blank **14** having an upper layer **15** providing a detail or pattern surface **16** and having an underneath surface **17**. The layer **15** is connected to a lower layer **18**, by means of the folded portion **19**, the said layer **18** having a surface **20** contiguous with the surface **17**, and a bottom surface **21**.

FIGURE 6, shows the photo-engraving **10** positioned within a slot **22** of a bottom support **23**, suitably supported in a conventional punch press (not shown). The sides of the slot **22** are tapered to receive the tapered edges **12** of the engraving to securely hold the same in position. A forming punch or die is designated at **24**, the same being attached to the upper ram of a punch press (not shown). The upper forming member **24** includes a flat surface **25** which engages the matrix **14** upon lower-

ing the ram. Stops **26** on the member **24** limit the downward travel of the member **24**. The stops have a dimensional height of .024 inch, which limits the downward travel of the member **24**, the stops engaging the upper surface of the support **23**, so that the edges of the matrix after forming have a dimensional thickness of .024 inch as shown in FIGURE 9.

The pressure utilized in the forming operation may vary from 30 tons to 70 tons, depending on the pattern detail as desired. As the forming member **24** compresses the matrix **14**, the detail **11** of the photo-engraving **10** is impressed in the matrix to provide positive detail in the form of projections or depressions which form the pattern for the subsequent slug to be cast. The projections of the pattern, are of course the depressions of the cast slug, and the depressions of the pattern on the other hand are the projections of the cast slug which do the imprinting.

The detail projections on the matrix of FIGURE 9, are designated at **30**, and the depressions are designated at **31**. The maximum projections of the matrix are designated at **32** and these form the relief which provides the deep depressions within the slug which in no manner print, but separates the detail from the edges of the matrix or slug. The maximum height of the projection **32** from the deepest depression is .030 inch as shown in FIGURE 9, and the maximum depression is .024 inch from the bottom surface **21** of the matrix. As shown in FIGURE 9, the top surface **16** has the projections **30** and depressions **31** in sharp detail, wheras in the second sheet **18** they are of lesser fine detail.

In the forming operation the two layers of aluminum of the matrix play an important part. They must definitely be connected, at least on one edge as shown by the folded portion **19**, or they may be stacked or riveted together so that they cannot move laterally relative to each other. A single layer of aluminum is ineffective since the detail produced is ineffective. The second layer of the matrix as here shown acts to cushion the forming operation, and by supporting the top layer, keeps the same from spreading indiscriminately and thus controls the forming operation. In other words the second layer controls and cushions the flow of the metal to produce a sharp detail on the pattern surface or face of the matrix.

The aluminum sheet used must be thicker than foil and of high tensile strength so that it can stretch and form without tearing during the high pressures encountered during the impression of the photo-engraving. It has been found that the desirable limits are .013 inch up to and including .018 inch, the aluminum having the desirable softness of a type as aforementioned in 1100 material with an "0" temper.

The surfaces of the aluminum blank should be flat, without any indentations. In other words, the surfaces should be smooth so that the contiguous edges of the sheet are absolutely flat as well as the pattern surface **16**. Indentations on the surface to be embossed are detrimental since they leave markings in the completed mat, which then are transferred to the slug and cause imperfect printing.

The edges of the matrix as shown in FIGURE 9 have a total thickness after impression of .024 inch. The material as specified before forming has a total thickness of .032 inch. Thus the material upon impression flows laterally, or becomes larger in over-all dimension. In other words, the thickness decreases and the over-all dimension expands. Thus a matrix can be made by the high production means afforded by a punch press type of production.

The matrix thus has now been produced and is ready to produce the cast slug. It is placed in the composing stick shown in FIGURE 10, and designated at **33**. This stick **33**, is placed in a suitable conventional casting machine (not shown) and lead in fluid form under pressure is poured into the cavity **34**, whereupon hardening the casting plate (or slug), (not shown), is formed. The lead is poured at a temperature of approximately 580° or more at a pressure of approximately from 400 to 600 lbs. per square inch. Generally the more precise the detail the greater the pressure is required.



The matrix because of its sharp detail and durability will be usable for many pourings. Since it is not susceptible to absorption of moisture, shrinkage and expansion is no problem. Another very important advantage of the aluminum matrix is that the material, after impression by the engraving plate or die, work hardens to a temper of H12, which in the art is known as quarter hard. This is advantageous since it adds strength and durability to the mat.

In FIGURES 11 and 12, the matrix blank is designated at **35**, and is formed of a tube **36** of aluminum, which is flattened by suitable pressure means, such as a press, rollers, etc. (not shown), to the flattened condition shown in FIGURE 12. The matrix **35** is thus connected at both sides by edges **37**. The matrix **35** is otherwise identical in dimensions and specifications as the matrix **14** and the same reference characters will apply. In complete form it will appear as the matrix **14** in FIGURE 9, with the exception both edges are joined, instead of only one.

Another distinct advantage of this alumium mat is that it readily dissipates heat during the casting of the slug. This is very desirable. On the other hand paper mats, insulate and are very poor in dissipating the heat thus causing difficulty in casting.

Thus the objects of the invention have been fully achieved and it must be understood that changes and modifications may be made without departing from the spirit of the invention or from the scope of the appended claims.

I claim:

1. A matrix for producing cast metal printing plates comprising first and second die pressed flat sheets of flowable and deformable common metal of a yield strength exceeding 4000 p.s.i. and connected together at their ends, so as to have respective lower and upper flat separated surfaces in contiguous relation and providing a separation between the surfaces for relative movement between the surfaces, said metal sheets being of the same material and substantially the same thickness, to provide an upper pattern surface on said first sheet including depressions and projections, extending through said first sheet and into said second sheet, said depressions and projections providing pattern detail.

2. A matrix for producing cast metal printing plates comprising first and second die pressed flat sheets of flowable and deformable common metal of a yield strength exceeding 4000 p.s.i. and connected together at their ends, so as to have respective lower and upper flat separated surfaces in contiguous relation and providing a separation between the surfaces for relative movement between the surfaces, to provide an upper pattern surface on said first sheet including depressions and projections, extending through said first sheet and into said second sheet, said depressions and projections providing pattern detail.

3. A matrix in accordance with claim 2, said sheets consisting of flat substantially smooth aluminum having a thickness of substantially .016 inch.

4. A matrix in accordance with claim 3, the matrix before impression having an edge thickness of substantially .032 inch and after forming having an edge thickness of substantially .024 of an inch.

5. A matrix in accordance with claim 2, said material consisting of aluminum, said sheets each having a dimensional thickness of .013 inch to and including .018 inch.

6. A matrix in accordance with claim 5, said aluminum having a temper of "0" or less.

7. A matrix in accordance with claim 6, said matrix having a dimension of approximately .032 inch along its edges before impression and forming an approximate dimension of .024 inch after forming an impression.

8. A matrix for producing cast printing plates comprising first and second flat aluminum sheets of flowable aluminum material connected together along one edge so as to provide respective separated upper and lower flat surfaces in contiguous relation with a separation between the surfaces to provide for relative movement of one surface with respect to the other, said matrix having its first sheet provided with a pattern surface of depressions and projections, and said depressions and projections also being included in said second sheet.

9. A matrix in accordance with claim 8 wherein said flat sheets are connected along laterally spaced edges.

10. A matrix for producing cast printing plates comprising first and second flat sheets of flowable and deformable common metal connected together at their ends, so as to have respective lower and upper flat separated surfaces in contiguous relation and providing a separation between the surfaces for relative movement between the surfaces, to provide an upper pattern surface on said first sheet including depressions and projections, extending through said first sheet and into said second sheet, said depressions and projections providing pattern detail, said flowable metal comprising substantially soft aluminum having work hardening characteristics.

11. A matrix for producing cast printing plates comprising first and second flat sheets of flowable and deformable common metal connected together at their ends, so as to have respective lower and upper pattern surfaces on said first sheet including depressions and projections, extending through said first sheet and into said second sheet, said depressions and projections providing pattern detail, said flowable metal comprising substantially soft aluminum having work hardening characteristics, said aluminum having a temper range between "0" and H14.




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