3 Sheets—Sheet 1.

H. C. MILLIGAN.

Metal-Seaming Machine.

No. 219,494. **Patented Sept. 9, 1879.**

Fig. 2.

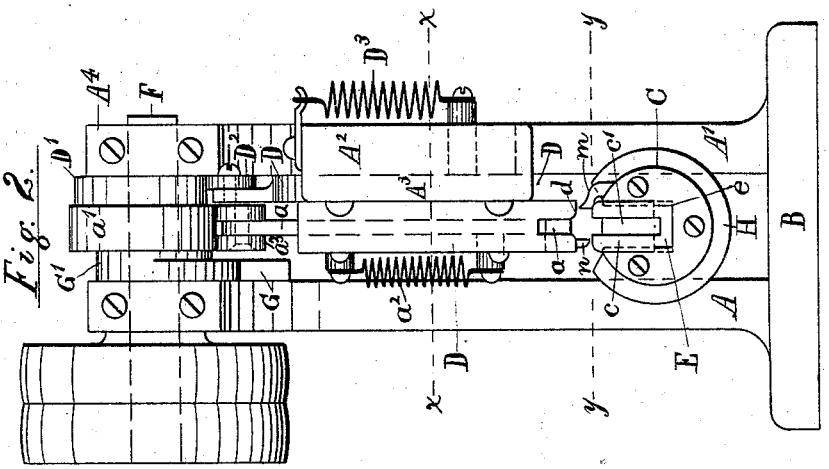
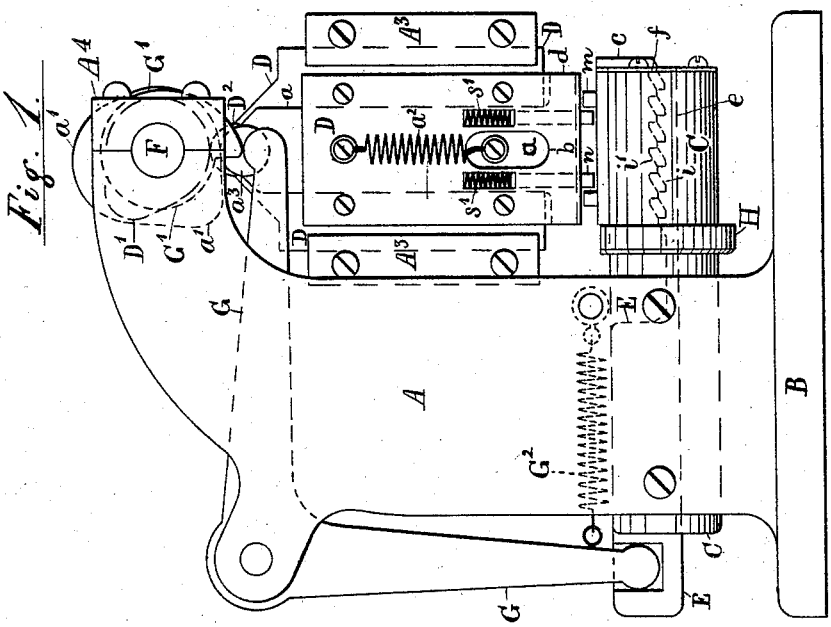


Fig. 1.



Attest:

Wm. L. Breath.

Wm. L. Dash

Inventor.

Henry C. Milligan, per

Thos. S. Crane, Atty.

H. C. MILLIGAN.
Metal-Seaming Machine.

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Fig. 3.

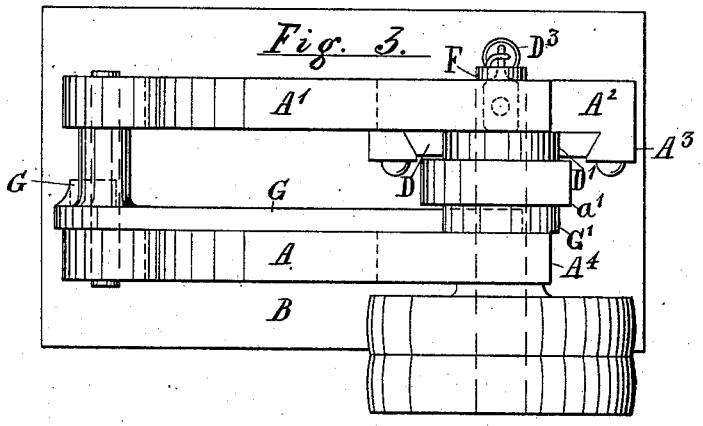


Fig. 4.

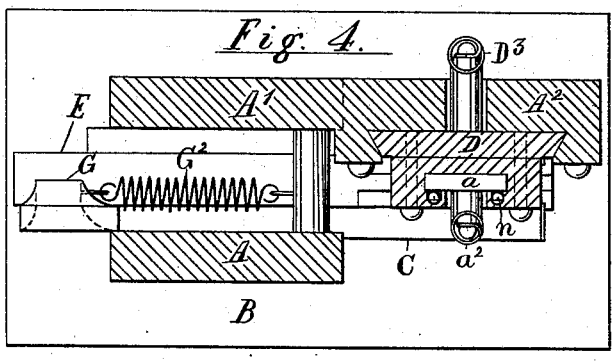
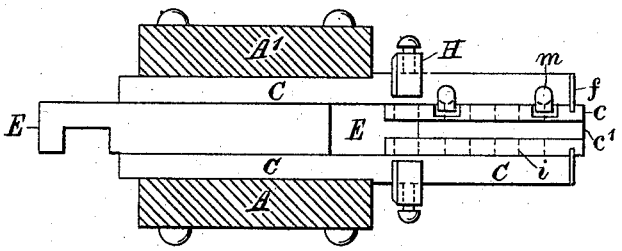


Fig. 5.



Attest:

Wm. L. Breath.

Wm. L. Fish.

Inventor.

Henry C. Milligan, Jr.

Thos. S. Crane, Atty

H. C. MILLIGAN.

Metal-Seaming Machine.

No. 219,494. Patented Sept. 9, 1879.

Fig. 6.

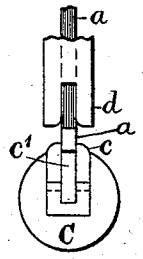


Fig. 7.

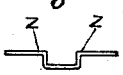


Fig. 8.

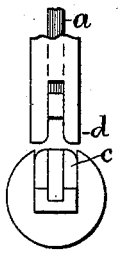


Fig. 9.

Fig. 10.

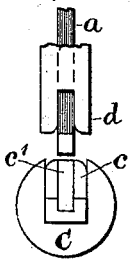


Fig. 11.

Fig. 12.

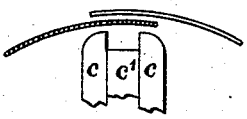


Fig. 13.

Fig. 14.

Fig. 16.

Fig. 18.

Fig. 17.

Fig. 19.

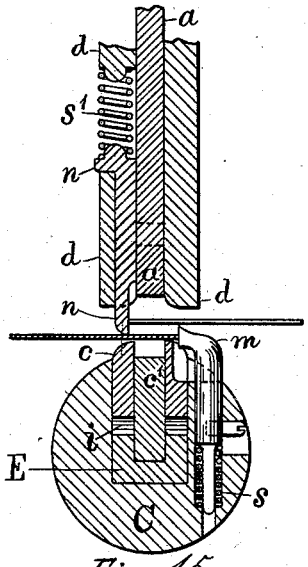


Fig. 15.

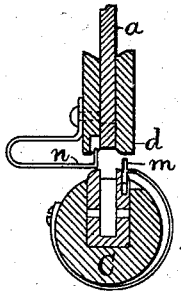
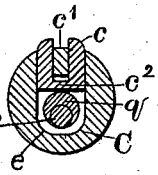


Fig. 20.

Fig. 21.



Attest:

W. L. Breath.

Wm. L. Fish.

Inventor.

Henry C. Milligan, per

Thos. S. Crane, Atty.

UNITED STATES PATENT OFFICE.

HENRY C. MILLIGAN, OF ELIZABETH, ASSIGNOR TO MILLIGAN, SAYCE & CO., OF NEWARK, NEW JERSEY.

IMPROVEMENT IN METAL-SEAMING MACHINES.

Specification forming part of Letters Patent No. **219,494**, dated September 9, 1879; application filed June 12, 1879.

To all whom it may concern:

Be it known that I, HENRY C. MILLIGAN, of Elizabeth, in the county of Union and State of New Jersey, have invented a new and useful Improvement in Metal-Seaming Machines, which improvement is fully described in the following specification.

My invention relates to an improvement in metal-seaming machines; and consists, first, in constructing the seaming-die with parallel sides raised above a bottom, which is afterward brought to a level with the sides, and used as an anvil for closing the seam, the construction being employed first to form an open channel in the seamed metal, and afterward to clinch or close the same into an impermeable seam; second, in the combination, with such a die, of a former or formers for inclining the sides of the open channel to receive the closing-pressure; third, in the combination, with the die and former, of a punch adapted to perform the double function of first forming the channel or open seam, and afterward of closing or clinching the inclined sides into an impermeable seam upon the bottom of the die; fourth, in the combination, with the die and former, of gages adapted to guide the metallic edges to be joined, and formed to yield as the other parts are brought in contact; fifth, in the construction and arrangement of the operative mechanism for moving the die, punch, and former, to make a completed seam in a single continuous operation.

My invention is illustrated by twenty-one drawings, in which Figure 1 is a side elevation of a power-machine fitted with my improvements. Fig. 2 is a front elevation of the same. Fig. 3 is a plan of the machine; Fig. 4, a horizontal section on the line *x x;* Fig. 5, a similar section on the line *y y;* Fig. 6, a view of the punch when forming the open channel shown in Fig. 7; Fig. 8, a view of the former when inclining the sides of the channel, as shown in Fig. 9; and Fig. 10, a view of the die with the sides lowered to permit the closing of the seam shown in Fig. 11 between the punch and the anvil *c* in the bottom of the die. Fig. 11 is a view of a closed seam formed from the open channel shown in Fig. 9; Fig. 12, a view of two pieces of sheet metal lapping over one another upon the die; Fig. 13, a channel formed in the edges of two such pieces; Fig. 14, a closed seam formed upon the edges of the pieces shown in Fig. 12; Fig. 15, a sectional view of the gages on a larger scale at their center lines, as well as the parts *c* and c^1, forming the die used in making my impermeable seam, the mandrel used for supporting the die *c* c^1, and the lower ends of the punch and former used with the die. Fig. 16 is a view of a channel formed from two edges overlapping, as shown in Fig. 15, and Fig. 17 a closed seam made from such a channel. Fig. 18 is a view of a channel with edges lapped still less, and Fig. 19 a closed seam formed from such a channel; Fig. 20, an alternative mode of constructing the gages, and Fig. 21 an alternative mode of operating the jaws of the die.

The frame of the machine consists of two standards, A A^1, and a bed, B. A mandrel, C, adapted to support tubular forms, as cams and boxes, when seaming, projects horizontally from the standards above the bed, and supports the die *c* c^1, used in joining the ends to be seamed; and bracket A^2, projecting from standard A^1 over the mandrel, carries between gibs A^3 a vertically-moving slide, D, bearing the former *d*. This former consists, essentially, of two metallic plates or bars, between which the punch *a* slides to enter the die, while the parted sides of the former stand vertically over the side pieces, *c*, of the die in the mandrel.

The center piece, c^1, of the die serves as the anvil in the final operation of closing the seam, and is shown in Fig. 2 as secured in a bar, E, which fills a deep groove, *e*, formed in the whole length of the mandrel C, on its upper side.

The bar E only partially fills the depth of the groove *e*, and the piece c^1 projects above it to the top of the mandrel, the movable side pieces, *c*, filling the remainder of the groove, and projecting, when in use, above the top of the mandrel, to form a die with parallel sides, into which the metal to be seamed is pressed by the punch *a* to form an open channel like that shown in Fig. 7.

This die is shown in the drawings as con-

sisting of the parts c and c^1, the part marked c being used in forming an open channel in the metal to be seamed, and the central part, c^1, being used to close the channel into the finished seam. The die thus performs two operations, in the first of which the sides c are raised above the bottom or center piece, c^1, and in the latter of which the three parts—viz., the two sides and the bottom—are brought to one level, that a flat surface may be presented to the punch a for closing the seam in the desired manner.

The piece c^1 receiving all the impact of the punch a, I have termed it the "anvil" in this description, and in the drawings have shown the sides c as movable, and arranged to be lowered to bring the three parts to a level when required.

A key, f, is fitted to a groove formed in the side of each piece c, which is projected beyond the front end of the mandrel for that purpose, and the pieces c are thereby limited to merely a vertical movement.

To raise and lower these side pieces (which I will term "jaws" in this description) automatically, the upper surface of the bar E beneath each jaw is formed with a series of inclined seats, i, and similar and opposing inclines i' are formed upon the lower sides of the jaws, which are thus raised when the bar is moved lengthwise in the groove e.

To operate the punch and former in proper order with the die $c\,c^1$, a cam-shaft, F, is provided in bearings A^4 over the center of the slide D, and carries a cam, D^1, which operates upon a roll, D^2, pivoted to the top of the slide; also, a cam, a^1, which operates upon a roll or rolls pivoted to the top of the punch a, and a cam, G^1, which operates upon one end of a lever, G, for moving the bar E to raise the jaws c.

The slide, punch, and lever G are all provided with springs to keep them firmly against the cams and to retract them after each seaming operation.

The spring a^2 draws the punch upward between the two sides of the former, being connected to one of the latter and to a pin projecting from the punch through a slot, b, in the former d.

The spring D^3 is secured at one end to the standard A^1, and serves to retract the slide and the former attached to it.

The spring G^2 operates upon the lever G, for a similar purpose.

The operation of the mechanism described is the same whether the edge or middle of a sheet is presented to it, and I will therefore first describe its action upon a single piece, and then the effect produced by gages which submit a greater or lesser proportion of the sheet's edge to the action of the punch and former d.

A collar, H, embraces the mandrel and serves as a stop for the metal placed upon it, and, the machine being stopped by any of the automatic clutches in common use, with the cams in the position shown in Fig. 1, the metal is placed upon the mandrel over the die $c\,c^1$ in contact with the collar, and the cam-shaft revolved.

The jaws c being raised to the position shown in Fig. 6, the punch is depressed and a quadruple bend made in the iron, forming the open channel shown in Fig. 7, the vertical sides of which are afterward to be folded down upon one another or upon the bottom of the channel.

The further rotation of the cam a^1 causes the withdrawal of the punch from the die at the same time that the bar E is drawn back by the lever G and cam G^1 and the jaws c allowed to drop downward. The former being then advanced by cam D^1 toward the jaws, as shown in Fig. 8, the metal at each side of the channel is bent downward, and, the inner edges of the formers d being rounded for that purpose, the sides of the channel are bent toward each other, as in Fig. 9, and disposed to fold together readily under any pressure directed toward the anvil c^1. The action of the former in thus inclining the sides of the channel, so that they will readily fold downward, is best understood by observing that the first contact of the former is at a little distance from the sides of the channel, as shown at $z\,z$ in Fig. 7, and the rounded or inclined edges of the former thus draw the sides together, as shown in Fig. 9. The formers are withdrawn upon the further revolution of cam D^1, as shown in Fig. 10, and the punch again forced downward to press the sides and bottom of the channel into the closed seam shown in Fig. 11.

The action of the machine upon a single piece of metal being thus understood, it will be seen that if two pieces are projected far enough over the dies from opposite sides, as shown in Fig. 12, to form a complete channel upon the edge of each piece, as in Fig. 13, the edges will be securely locked together when the action of the machine is completed, as shown in Fig. 14, the edge of the upper piece in Fig. 12 being bent in three places, and fitting within the bottom and both sides of the closed seam. Should the upper piece project less, as in Fig. 15, where the gages are shown in section on their center lines to display the construction more clearly, it may be bent in but two places by the descent of the punch, and fill but two of the three sections of the channel, as shown in Figs. 16 and 17. Should it project still less, it may have but a narrow edge, bent downward by the punch, which will simply hook under one side of the channel, as shown in Figs. 18 and 19.

To determine the kind of seam to be formed, I provide a lower gage, m, adapted to form a complete channel upon the edges to be united, and an upper gage, n, which may be adapted to make any of the seams shown in Figs. 12 to 19.

The lower gage is formed by inserting in the mandrel, by the side of jaw c, two spring-pins, m, which are bent at their tops to stop the metal inserted over the opposite jaw, and are supported by springs s, fitted beneath

them in sockets in the mandrel. The tops of the pins are forced downward by the descent of the formers *d*, and their bent ends are received in notches cut in the mandrel beside the jaw.

The upper gage is formed by inserting spring-pins *n* in the lower edge of the former on the side of the die opposite pins *m*. The pins *n* are pressed downward by springs *s'*, but do not extend quite to the surface of the jaws. The lower sheet of metal to be joined may therefore have its edge pushed under the upper gage, while the opposing edge may be inserted over the top of the lower gage without interfering with the action of the lower gage or meeting any obstruction to its free introduction.

Although both gages are attachments of the die *c* c^1, and used solely to regulate the position of the metallic edges over the die, it will be seen that one of them is secured to a point of support above the die, which, in this case, is the former *d*.

Instead of using pins as gages, they may be made of spring-steel, and be secured by their outer extremities, being free to yield, as described above, at their inner ends. Such an arrangement is shown in Fig. 20, the same letters being applied to the parts as before.

The jaws *c* may be operated by any device equivalent to the inclines *i*, provided they are rigidly supported during the action of the punch *a* between them.

It will be noticed that the inclines *i* not only raise the jaws, but, being provided, as well as those on the jaws themselves, with flat tops and bottoms, they serve to lock themselves when fully thrown into the working position shown in Fig. 1, and firmly resist the pressure applied to the tops of the jaws.

An equivalent arrangement serving to raise and lock the jaws *c* when required is shown in Fig. 21, where the jaws are shown united by a tie-piece, c^2, beneath the center bar, c^1, which is then supported at each end and has no motion whatever, and an eccentric, *q*, is arranged beneath the tie-piece c^2, and revolved at the proper time by a shaft, *r*, inserted within a cavity in the mandrel, and operated by suitable connections at its rear end to the cam-shaft F.

It is not essential to the operation of my invention that the sides of the die should be movable and the bottom fixed, as the object of that arrangement is to permit the action of the former in bending the sides of the channel and the action of the punch in closing the seam against the anvil c^1 without interference from the projection of the sides *c* above the bottom c^1. This object can be fully attained by raising the piece c^1, after the channel is formed, to a level with the sides *c* instead of depressing the sides to a level with the bottom.

If the former *d* were first set quite close to the top of the jaws *c*, such a movement of the piece would have the same effect that is shown in Fig. 10 as produced by the downward motion of the punch against a stationary anvil. The seam could also be finished with equal facility by the descent of the punch upon the raised anvil c^1. I do not, therefore, limit myself to the precise means shown for operating the several parts of the die, as *c* c^1, in conjunction with the former *d* and punch *a*, as various equivalent devices may be used effecting the operation herein described and claimed.

In place of the shaft F, with its various cams, I have applied the die, punch, and former to a lever foot-press, operating the slide D by a link to the top of the lever, and effecting the other necessary movements by cam-shaped slides connected to other parts of the foot-lever. I therefore claim the die, punch, and former, when operating substantially as herein described, independently of the operating mechanism, which may be modified to suit the machine to which these essential parts are applied.

I claim—

1. The combination, in a metal-seaming die, of the parallel sides or jaws *c* with the bottom c^1 and suitable mechanism for bringing the sides and bottom to the same level, after the formation of an open channel between the jaws *c*, to form an anvil, for the purpose herein set forth.

2. The combination, with a die and punch adapted to form the open channel herein described, of a former operating to incline the sides of the open channel by a movement in the same direction as the punch, and by the contact of its rounded edges with the metal adjacent to the sides of the channel, as herein set forth.

3. The seaming-die constructed with sides or jaws *c* and bottom c^1, operated substantially as shown and described, in combination with the former *d* and with the punch *a*, for the purpose herein set forth.

4. The combination and arrangement of the gages *m* and *n* with the mandrel C and former *d*, substantially as described, for gaging two lapping edges of sheet metal, one in a plane above the other, for the purpose shown and described.

5. In combination with the die supported by the mandrel C, the punch *a*, operating between the sides of the former *d*, and the cams a^1, G^1, and D^1, constructed substantially as shown and described, for operating the parts of the die, the punch, and the former, in the manner herein set forth.

In testimony that I claim the foregoing I have hereto set my hand this 10th day of June, 1879, in presence of two witnesses.

HENRY C. MILLIGAN.

Witnesses:
W. D. BREATH,
THOS. S. CRANE.