

W. C. EDWARDS.
PORTABLE MAGNETIC RIFFLE.

No. 451,208.

Patented Apr. 28, 1891.

Fig. 1

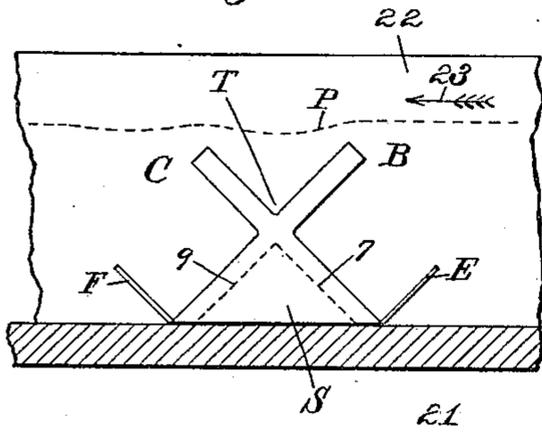


Fig. 2

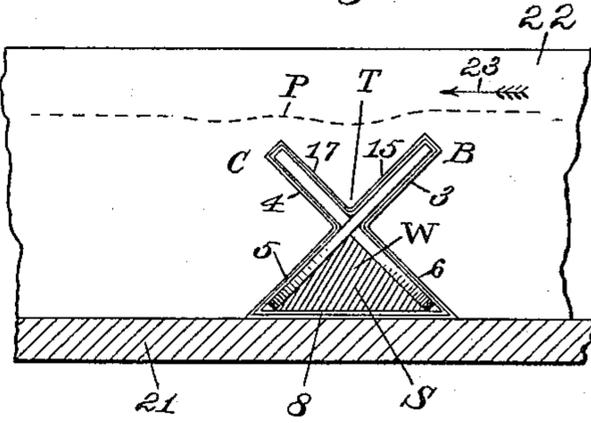


Fig. 3

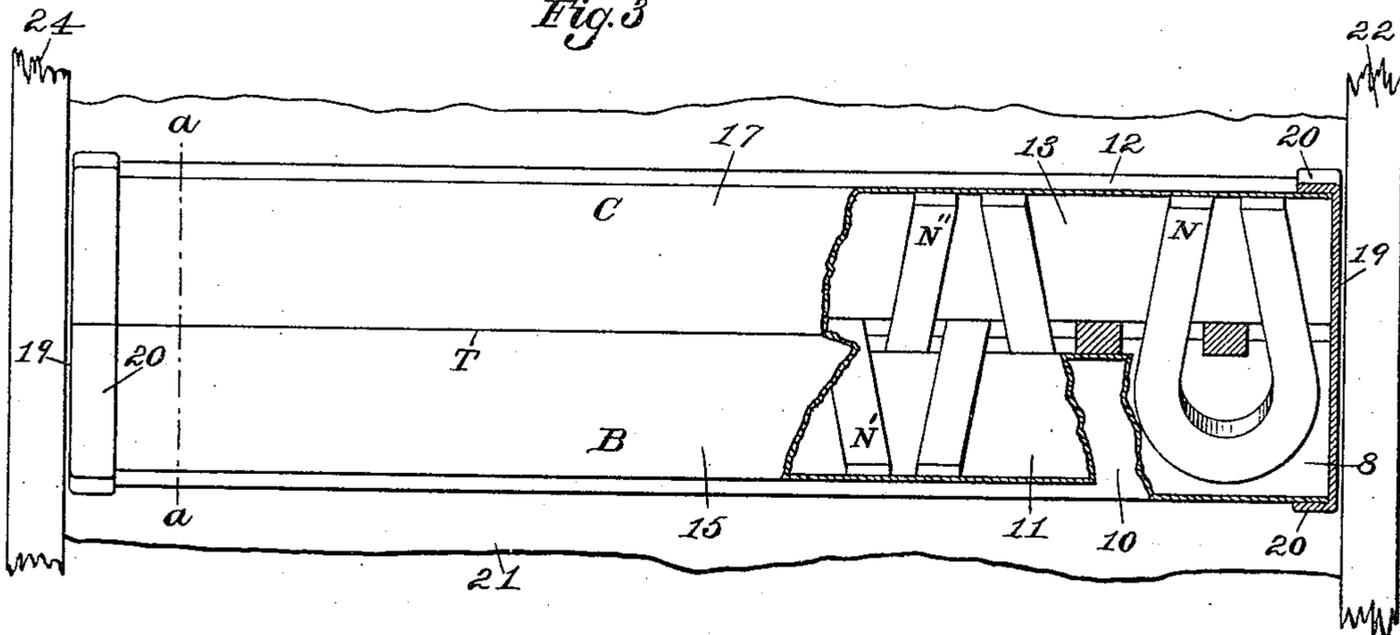


Fig. 7

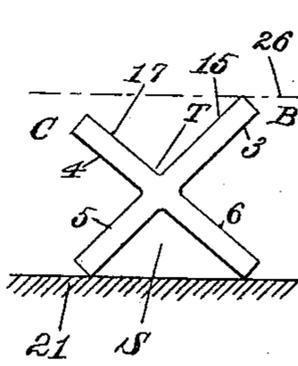


Fig. 4

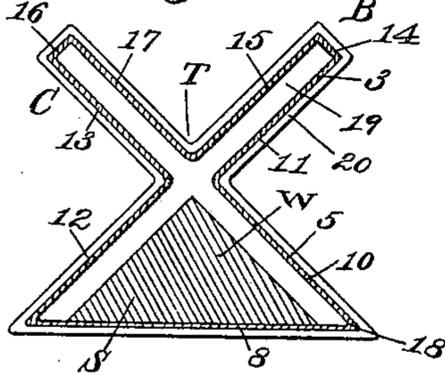


Fig. 5

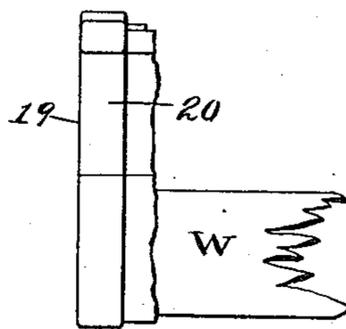
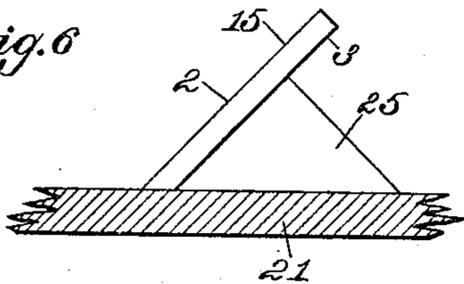


Fig. 6



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Fig. 8

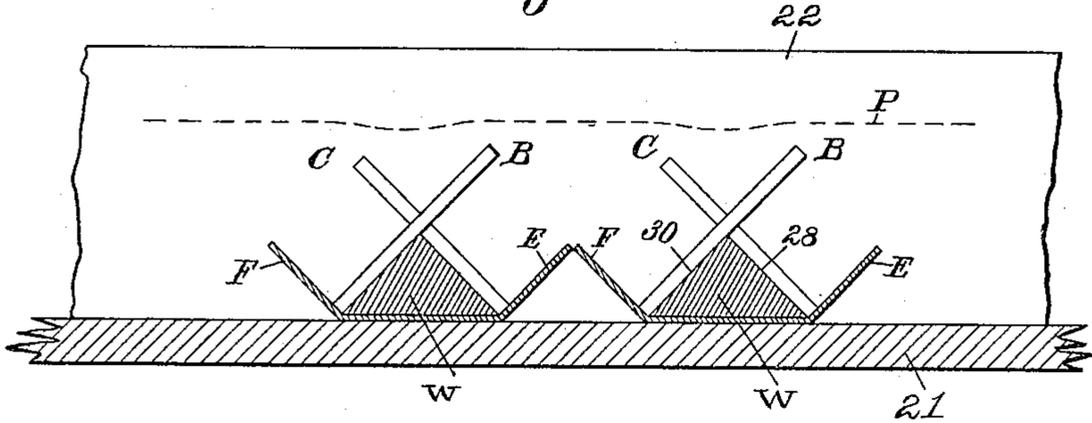


Fig. 9

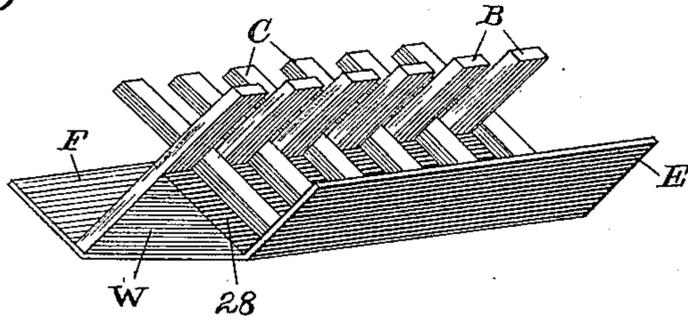


Fig. 12

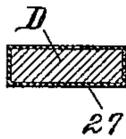


Fig. 11

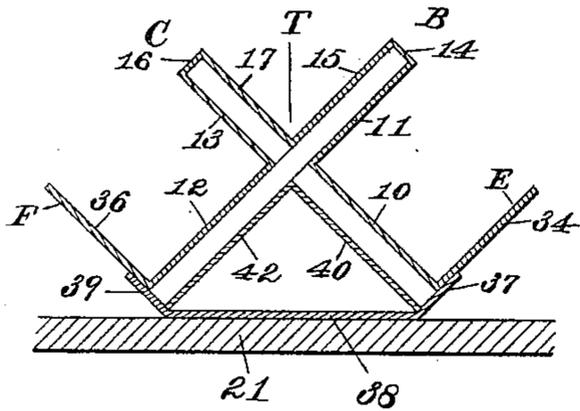
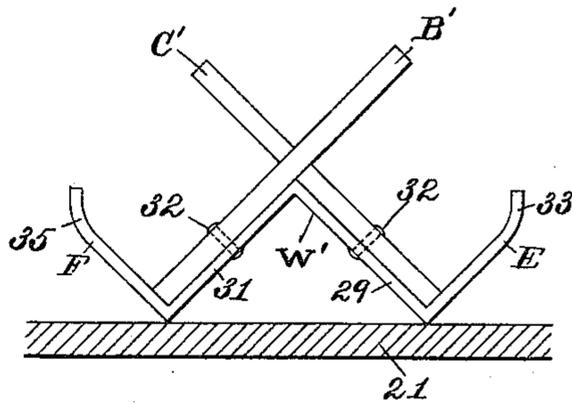


Fig. 10



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UNITED STATES PATENT OFFICE.

WILLIAM C. EDWARDS, OF HOLYOKE, MASSACHUSETTS, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, OF ONE-HALF TO ROSWELL M. FAIRFIELD, OF SAME PLACE, AND OSCAR S. GREENLEAF, OF SPRINGFIELD, MASSACHUSETTS.

PORTABLE MAGNETIC RIFFLE.

SPECIFICATION forming part of Letters Patent No. 451,208, dated April 28, 1891.

Application filed December 11, 1890. Serial No. 374,305. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM C. EDWARDS, a citizen of the United States, residing at Holyoke, in the county of Hampden and State of Massachusetts, have invented certain new and useful Improvements in Portable Magnetic Riffles, of which the following is a specification.

This invention relates to magnetic riffles for separating metallic particles from paper-pulp, the object being to furnish a portable apparatus in which the magnetism is furnished by permanent magnets arranged and combined for effective action and protected from contact with the pulp.

In the drawings accompanying and forming a part of this specification, Figure 1 represents a vertical longitudinal section through a trough for conveying the paper-pulp, and shows in end elevation a magnetic riffle embodying my present improvements. Fig. 2 is a view similar to Fig. 1, showing the riffle in section. Fig. 3 is an enlarged top view of the riffle, the right-hand end thereof being shown broken away for illustrating the arrangement therein of the horseshoe-magnets. Fig. 4 is an enlarged cross-sectional view in line *a a*, Fig. 3, of the riffle with the magnets removed. Fig. 5 is a side view of one end of the riffle for illustrating the construction thereof. Fig. 6 is a view similar to Fig. 1, showing the riffle in its simplest form. Fig. 7 is a view showing the riffle of a form having two intersecting magnet-cases, one of which cases supports the other to elevate the magnet-poles. Fig. 8 is a view similar to Figs. 1 and 2, showing in end elevation two portable riffles embodying my improvements in a simple form. Fig. 9 is a perspective view of the form of the riffle shown in Fig. 8, corresponding also to the form shown in Fig. 1. Fig. 10 is an end elevation illustrating a modification of the riffle. Fig. 11 is a view corresponding to Fig. 4, and illustrates certain features of my improvements applied to that form of the riffle in which the magnets are protected by a magnet-inclosing case. Fig. 12 is a diagrammatic view illustrative of the protected magnet.

Similar characters designate like parts in all the figures.

The portable magnetic riffle shown in the drawings consists in its most complete form of a tubular casing, a series of magnets contained in the casing, means for holding the magnets in place, and means closing the ends of the case. The riffle is adapted to be made in two forms having a single set and a double set of protected magnets, respectively. The simplest form, having only one set of magnets, (these being protected by plating or by incasing,) is illustrated in an end elevation in Fig. 6, and consists of the magnet or magnet-inclosing case 2 and a case-holder or base 25 for supporting the riffle in the proper position for use, with the effective magnet-poles elevated.

The riffle in its more complete form, having two sets of magnets, is shown in end elevation in Fig. 1, in section in Fig. 2, and in plan view in Fig. 3. In this form the riffle consists of a case having magnet-inclosing wings set in crosswise directions. Said wings are designated in a general way by B and C, the upper and lower portions of the wing B being designated by 3 and 5, respectively, while the upper and lower portions of the other wing C are designated by 4 and 6, respectively. Said wings may form in end elevation a simple cross, as indicated in Fig. 7 and by dotted lines 7 and 9 in Fig. 1; but I prefer, for reasons hereinafter set forth, to inclose the space S, Figs. 1 and 7, by a lower wall 8, Figs. 2, 3, and 4. When thus constructed, the riffle or case consists of said lower wall 8, the upwardly and inwardly inclined walls 10 and 12, the upwardly and outwardly inclined walls 11 and 13, the end walls 14 and 16 of the upper wings B and C, respectively, and the downwardly-inclined walls 15 and 17, meeting at the intersection of said wings. This entire series of walls or surfaces is or may be formed of a single piece of metal bent at the angles substantially as shown in Fig. 4 and joined at 18 by a soldered lap or joint in a well-known manner. The ends of the case are closed by the end wall 19, having flanges, as 20, extending entirely around the periphery thereof and adapted to be soldered or otherwise closely secured to the tubular case, so as to exclude air and water therefrom.

The magnets are contained in the wings of the riffle-case, as will be understood by comparison of Figs. 2 and 3. One of said magnets extends from one side of the bottom of the riffle upward to the top of the wing B, while the other of said magnets extends from the opposite side of the bottom of the riffle to the top of the opposite wing C. The magnets, when these are "horseshoe" magnets, as indicated at N, Fig. 3, may be interlocked, as indicated by the magnets N' and N'', thus economizing space and securing the greatest number of magnets in a riffle of a given size. In this connection it should be observed that in practice it is desirable to use the strongest magnetic force available, so as to take out of the flowing paper-pulp even the smallest of the magnetizable particles contained therein. The riffle should be of a length corresponding substantially with the width of the trough, which, as herein shown, consists of the bottom 21 and the sides 22 and 24.

In using the riffles it is only necessary to set a sufficient number of them at intervals along the trough or sand-box, as will be understood from the drawings, so that the pulp flows against the same and over the top thereof, as indicated by the wavy dotted line P, Figs. 1 and 2.

The action of the pulp of the inclined magnetic wings B and C of the riffle is of a peculiar nature, the inclination of the magnetic surfaces co-operating with the pulp-current to more effectually secure the magnetizable particles flowing therein. The pulp approaching the riffle in the direction of the arrow 23, Fig. 1, any magnetizable particles therein are attracted to the wings B and C, and if lodged on the top thereof are by the force of the current gradually carried down to finally lodge in the trough at T, where the collected magnetizable material is finally held between the two wings B and C, and if the magnetizable material strikes the under magnetic surface 3 of the riffle the current naturally carries the same downward rather than upward, and thus tends to remove said particles from the more rapid upper currents in the pulp-trough.

One feature of the complete or duplex form of the riffle is shown in Fig. 7, where the wing B stands at a greater elevation than the wing C, as will be observed by means of the horizontal dotted line 26 in said figure. The effect of this is to create a fall over the riffle B, which tends to drive the collected material downward on the surface 15 into the trough T, and at the same time to direct the floating particles more directly toward the wall 17, thus subjecting the said floating particles to the combined action of attraction and momentum. This action is impliedly shown by the dotted line P in Figs. 1 and 2 by the downward curve of said line between the wings B and C.

As a means for holding the magnets in place and giving stiffness and strength to the entire structure, the space S is filled with a block

W, Figs. 2, 4, and 5, which block should extend from end to end of the riffle, and furnishes a rigid base on which to assemble the magnets. Owing to the rigidity secured by the use of said block, the magnet-case may be made of very thin sheet-copper or other non-magnetic sheet material, thereby securing a high degree of efficiency of the magnets by permitting the material to be acted upon to come closer to the magnet-poles into a stronger magnetic field.

It should be understood from the foregoing description that the magnet-inclosing case described is for the double purpose of protecting the magnets from the pulp and also of giving to the riffle as a whole a smooth exterior; but that mode of protecting the magnets is not essential in the simpler forms of the riffle, since, as indicated by the darkened layer 27 in Fig. 12, the magnet-bar D may be protected by a surface layer or coating—as, for instance, of non-magnetic metal inseparably placed thereon by the process of electro-deposition.

In practice any coating of the magnets with a material non-magnetic and adapted to resist the action of the paper-pulp may be employed. The magnets, whether in the form of horseshoe-magnets, as shown in Fig. 3, or of straight-bar magnets, as shown in Figs. 8 and 9, may be assembled upon the oppositely-disposed sides 28 and 30 of the base W, the magnets which are assembled upon one of said sides being set in alternation with those which are assembled on the opposite side, as best shown in the perspective view, Fig. 9. When thus assembled, each of said magnets is set upon an incline, and the magnets of one set, when the riffle is set crosswise of the pulp-trough, as in Figs. 3 and 8, stand with their poles directed against the pulp-current. This arrangement increases the efficiency of these magnets, since the current, coacting with the inclined surfaces of the magnets and the attraction thereof, tends to carry down the magnetizable particles toward the bottom of the pulp-trough, and thus separate said particles from the onflowing current of pulp.

The particular form and construction of the base on which the magnets are assembled and by which they are supported may be varied within the scope and limits of my invention. As shown in Figs. 2, 3, 4, 5, 8, and 9, said base (designated in a general way by W) is represented as a solid block—as, for instance, of wood or non-magnetic metal, or of other suitable substance, as hard rubber or the like.

In Fig. 10 the base W' comprises the two walls 29 and 31, to which the magnets B' and C' are represented as being fixed by means of rivets, as 32. In this form of riffle (shown in Fig. 10) the troughs E and F at the sides of the riffle are readily formed by an upturned extension, as 33 and 35, integral with the said base-walls 29 and 31, respectively. This

form of riffle-base is obviously equally well adapted for the straight-bar magnets shown in Figs. 8 and 9, or for the horseshoe-magnets shown in Figs. 2 and 3.

5 When the magnets are to be protected by incasing, as in Figs. 2 to 5, inclusive, the riffle may be constructed as indicated in the cross-sectional elevation in Fig. 11, (which corresponds substantially to Fig. 4,) and may have
10 its ends closed by end plates, substantially as described in connection with Figs. 3, 4, and 5. In this form of riffle (shown in Fig. 11) the troughs at the sides of the riffle are formed by the upturned lower edges 34 and
15 36 of the outer lower walls 10 and 12, respectively, while the base proper is formed of the plate 38, whose edges are upturned, as at 37 and 39, to cover the lower ends of the magnet-receiving wings B and C, respectively.
20 In this form of riffle-case the base-walls, on which the magnets may be said to be "assembled," are the walls 40 and 42, formed of a separate piece set on the afore-said base-plate 38 and suitably fixed in place.

25 Having thus described my invention, I claim—

1. A portable magnetic riffle consisting of a series of magnets inclosed in non-magnetic covering and fixed on a base holding the magnet-poles elevated.
30

2. A portable magnetic riffle consisting of a series of inclined magnets supported on a base holding the magnet-poles elevated, substantially as shown.

35 3. A magnetic riffle consisting of a suitable base or magnet-support, magnets supported on said base, and a trough underneath the magnet-poles and on the base of the riffle.

40 4. In a magnetic riffle, the combination, with a base having oppositely-disposed inclined sides, of a series of magnets on each of said sides and set in alternation, substantially as shown and described.

45 5. In a magnetic riffle, the combination, with a base, substantially as described, of horseshoe-magnets set on the opposite sides of said base, the magnets on one side of the base interlocking with those on the other side thereof, substantially as described.

6. The combination, with a pulp-trough, of a magnetic riffle having one or more inclined magnets set with the elevated poles thereof directed against the pulp-current. 50

7. A magnetic riffle consisting of a closed magnet-inclosing case, a magnet or magnets inclosed in said case, and means supporting the case to elevate the magnet-poles. 55

8. A magnetic riffle consisting of intersecting magnet-cases and magnets inclosed in said cases, the riffle having a base on which it may be set to elevate the magnet-poles. 60

9. A magnetic riffle consisting of a closed magnet-case having intersecting magnet-receiving spaces, a series of magnets in said spaces, and a block, substantially as described, supporting the magnets and inclosed in the magnet-case. 65

10. In a magnetic riffle, the combination, with the magnet-inclosing case having a magnet-receiving space, substantially as described, of the ends 19 and 19, closing said case, the whole forming a portable magnetic riffle having a base on which it may be set for elevating the magnet-poles. 70

11. In a magnetic riffle, the combination, with a closed magnet-case having intersecting magnet-receiving spaces, of a series of magnets in said spaces, the magnets in one space alternating with those in the other space. 75

12. In a magnetic riffle, the combination, with a magnet-case having intersecting magnet-spaces, of horseshoe-magnets in said spaces, the magnets in one space interlocking with those in the other space, substantially as described. 80

13. A magnetic riffle consisting of intersecting magnet-cases and magnets in said cases, the riffle having a base on which it may be set to elevate the magnet-poles, and the whole being constructed to elevate one magnet-case above the other, substantially as described. 85 90

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