(No Model.) 2 Sheets—Sheet 1.

G. & E. ASHWORTH.

APPARATUS FOR HARDENING AND TEMPERING WIRE FOR CARDS.

No. 252,413. Patented Jan. 17, 1882.

FIG. 1.

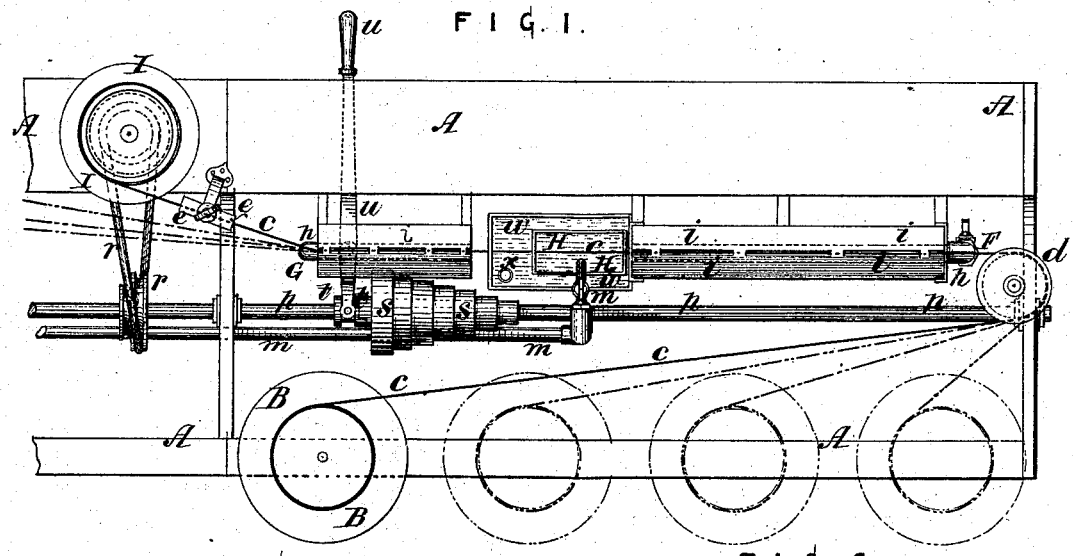


FIG. 2.

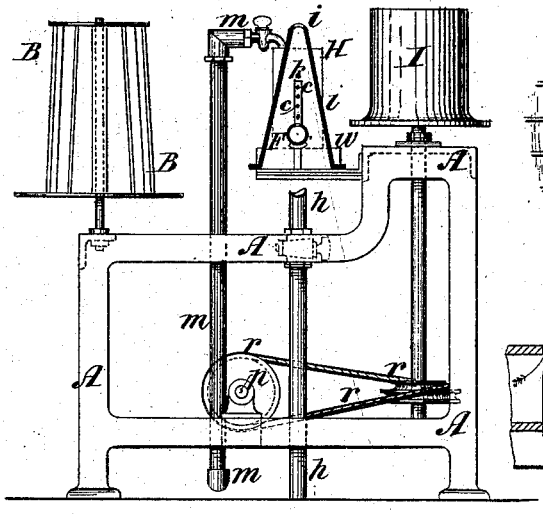


FIG. 4.

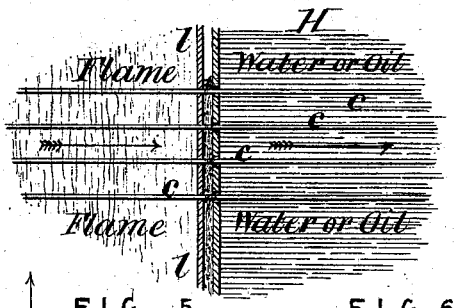


FIG. 5.

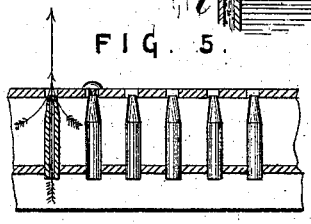
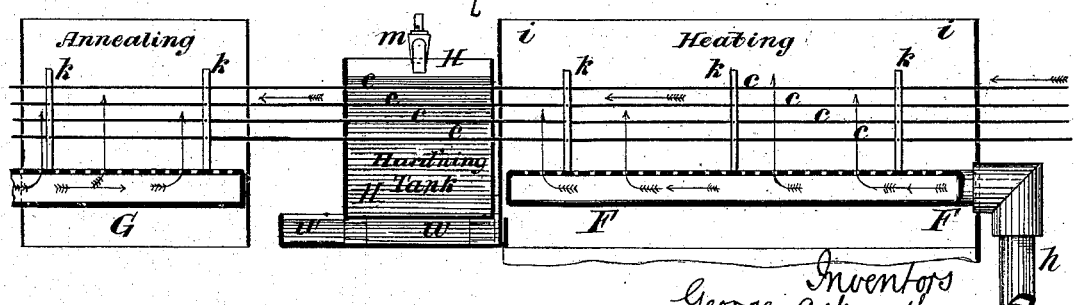


FIG. 6.

FIG. 3.



Witnesses
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Henry Howson Jr.

Inventors
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by their Attorneys
Howson and Son

(No Model.) 2 Sheets—Sheet 2.

G. & E. ASHWORTH.

APPARATUS FOR HARDENING AND TEMPERING WIRE FOR CARDS.

No. 252,413. Patented Jan. 17, 1882.

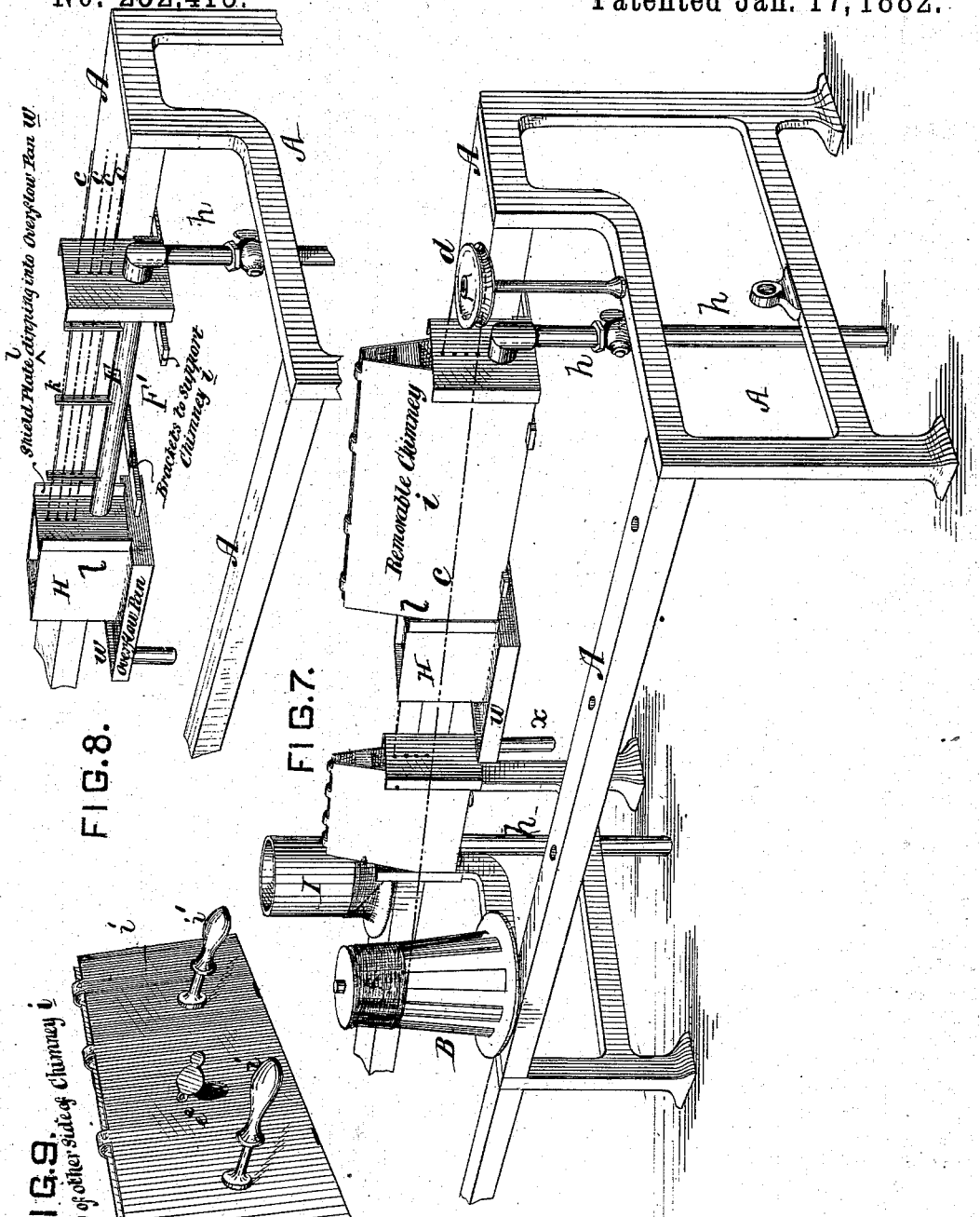

FIG. 8.

FIG. 7.

FIG. 9. View of other side of Chimney i

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by their attorneys.
Howson and Sons

UNITED STATES PATENT OFFICE.

GEORGE ASHWORTH AND ELIJAH ASHWORTH, OF MANCHESTER, COUNTY OF LANCASTER, ENGLAND.

APPARATUS FOR HARDENING AND TEMPERING WIRE FOR CARDS.

SPECIFICATION forming part of Letters Patent No. 252,413, dated January 17, 1882.

Application filed December 22, 1879. Patented in England September 5, 1878, and in Germany December 1, 1878.

To all whom it may concern:

Be it known that we, GEORGE ASHWORTH and ELIJAH ASHWORTH, both of Manchester, in the county of Lancaster, in the Kingdom of Great Britain and Ireland, have invented a new and useful Improvement in Apparatus for Hardening and Tempering Wire for Cards and other Purposes, (for which we have obtained British Patent No. 3,513, dated September 5, 1878, and German Patent No. 6,977, December 1, 1878,) of which the following is a specification.

Our invention relates principally to the treatment of wire for wire cards employed in and in connection with the carding of cotton and other fibrous substances, and has for its object to increase the useful effect and durability of such cards. We draw the wire in a straight line through a gas-flame or line of gas-flames, and then through a bath or stream of oil, or of oleaginous matter, or of a suitable liquid or matter, and then through a carefully-regulated gas-flame or line of gas-flames, in order to burn off the oil to some extent, and thereby to impart the required temper. The wire is then conducted to the drum upon which it is wound; but in order to make the coil rise upon the drum we put a tension on the wire, which may conveniently be effected by passing the wire between rows of pins or between friction-surfaces.

In the accompanying sheets of drawings, Figure 1 represents a plan of our improved apparatus. Fig. 2 is an end view, partly in section. Fig. 3 is a longitudinal section of part of the apparatus, drawn to a larger scale; Fig. 4, an enlarged sectional diagram. Figs. 5 and 6 illustrate a modification in the form of burner employed. Fig. 7 is a perspective view of the apparatus with the driving appliances removed; Fig. 8, a similar perspective view of part of Fig. 7 with the chimney *i* removed; Fig. 9, an enlarged perspective view of the chimney *i* detached.

In the drawings, A is a framing, which carries the various parts of the apparatus. Upon this framing are mounted reels, upon which the wire to be hardened is supplied to the machine. One reel is seen at B. The positions of other similar reels are indicated by dotted circles. The wire *c* is led from the reel partly around a carrier-pulley, *d*, at one end of the machine, and passes in a straight line through the hardening and tempering parts of the apparatus. Below the wire are fixed two gas-burners, F and G. In the example these gas-burners consist of tubes which are perforated on their upper sides, and are supplied with gas by means of suitable connecting-pipes, (indicated by *h h*.)

Any form of burner which will furnish sufficient flame may be used.

The flame of the burner F or of each burner is protected by means of a sheet-metal shield or chimney, *i*, which acts in a similar manner to the glass chimney of a lamp by shielding the flame from drafts, thereby steadying it. The shield forms a long narrow chimney, open at the top and bottom.

The form and arrangement of the shield or chimney for steadying the flame may be varied as found to be most suitable; or, if not considered to be necessary, the shield or shields may be dispensed with; but we prefer to make it of the form more fully illustrated in Fig. 9—that is, of two sheet-metal plates arranged at an angle to each other, connected at the top and ends by strips, and provided with handles i' and a peep-hole, e^2.

The wire passes through eyes in guides *k*, which steady the wire and keep it in a straight line. The wire passes immediately from the flame of F through a perforation in a vertical plate, *l*, which guides the wire and at the same time shields the cistern H from the heat to some extent. The wire passes from the plate through a perforation in the end of the cistern H, and, passing across this cistern, leaves it through a perforation in the other end thereof.

Arrangements are made for supplying a constant stream of oil, water, or other suitable liquid to this cistern. In the example, the liquid—say oil—flows through a pipe and regulating-cock, *m*, from a suitable supply-cistern. The perforation through which the wire enters the cistern is larger than is necessary for the

mere passage of the wire, so that there is a constant flow of oil through this perforation.

In practice we operate upon a number of wires—say, for example, upon four wires—at once. In the drawings four wires are shown passing through eyes in vertical guides *k k*, and through perforations in the ends of the cistern H, these guides keeping the wires in parallel straight lines.

In Fig. 4 the plate *l* and the end of the cistern H are shown in section larger than the full size of the parts in the apparatus we have constructed. The distance of the plate *l* from the end of the cistern is such as that there is just about enough space for the downward flow of the oil. The plate *l* shields the cistern from the heat of the flame, and the flow of oil tends to prevent the overheating of the plate. By these means the cistern is brought close to the end of the line of flame, so that the heated wires pass directly and instantaneously from the flame into the oil without being exposed to the air in the transition. This is very important, as the fine wires could not be hardened if the transition were not instantaneous. It will be seen that the heated wires enter the oil flowing through the space between the cistern and the plate *l* before actually entering the cistern.

We may dispense with the cistern and cause the wire to pass directly from the flame into a falling or flowing stream of oil or liquid.

The burner G is used to temper the wires. It is desirable to be able to regulate the length of the line of flame of this burner. To shorten the flame we insert pins, plugs, or stoppers into some of the perforations in the burner, leaving only as many open as may be required. This method of regulating the length of the line of flame may be varied—as, for example, the perforations may be divided into groups, each separately supplied through a stop-cock. The flame F may also be made adjustable in length. The wires now hardened and tempered are wound upon drums. One drum, I, is shown in the drawings. The other drums would be mounted upon the part of the framing which is supposed to be broken off in the drawings. These drums are fixed upon vertical shafts which receive motion from a horizontal shaft, *p*, through the pulleys and cords *r r*, Figs. 1 and 2. The shaft *p* receives motion from a suitable driving-shaft through a pair of cone strap pulleys.

The cone on the shaft *p* is marked *s*. This cone is loosely mounted on the shaft, and gives motion to it through a clutch, *t*, which can be quickly thrown into and out of gear by means of a lever, *u*, which is operated from the front of the machine to stop or start the drums. The speed of traverse of the wires is regulated by means of the said cone-pulleys. A friction-disk and sliding pinion or plain cone-drums or other equivalent means may be employed for the same purpose. The operation requires to be conducted with a careful regulation of the action of the apparatus; and as the effect of the hardening and tempering processes may be governed to a great extent by varying the speed of traverse of the wire, we employ the said cone-drums or equivalent devices.

To make the coils rise properly upon the drums a tension is put upon the wires. To effect this we pass each wire through a friction-clamp, *e*, Fig. 1, consisting of a pair of plates or friction-blocks, which are pressed together by means of a clamping-screw or of a spring. Other means may be employed—as, for example, the wire may be drawn between two rows of pins. The oil, water, or hardening fluid flowing from the cistern falls into a receiver, *w*, whence it is conveyed by a pipe, *x*, Fig. 1, to a suitable cistern. The fluid is returned to the elevated supply-cistern by means of a pump, or is otherwise returned in any suitable manner.

Although we prefer the wire to pass in a straight line through the cistern, it might pass over the edge of the cistern and be deflected downward into it, the cistern being kept quite full of oil; but we do not believe that an equally good result could thereby be obtained. The flame of the burner G is so regulated as to just render the wire capable of being bent in the machine without softening it more than is required for such bending.

We may arrange the burner G in a separate framing, so that the burning or tempering will become a second operation.

In the hardening of wire we may employ a hot smokeless flame, such as is produced by a Bunsen burner—as, for example, a row of burners on the Bunsen principle may be arranged close together, so that the flames unite, and may be provided with separate gas-cocks, so that the length of flame can be regulated as may be required; or air under pressure may issue with the gas, as in the case of ordinary gas blow-pipes. Figs. 6 and 7 illustrate an arrangement for this purpose wherein a jet of hot or cold air is injected into the center of each jet of gas. Any suitable kind of gas may be used, and the flame of burning oil or gas produced in the apparatus may be used in lieu of the gas conveyed in pipes to the apparatus.

We wish it to be understood that the card-tooth produced from the hardened and tempered wire above described forms no part of this case, but may form the subject of a separate application.

Apparatus constructed substantially as indicated may be employed in the treatment of wire which is to be used in the manufacture of wire brushes or for other useful purposes.

We claim as our invention—

1. A wire hardening and tempering apparatus having the following elements: a gas-burner, F, for heating the wire, a gas-burner, G, for annealing the wire, an intermediate tank containing hardening-liquid, and drums for

drawing the wire through the two gas-flames and the intermediate tank, all substantially as described.

2. The combination of the burner F and guides *k* with shield *i*, as set forth.

3. The within-described wire hardening and tempering apparatus, consisting of the burners F and G, cistern H, perforated at both ends, guides *k*, plate *i*, and drums I, all substantially as set forth.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

GEO. ASHWORTH.
ELIJAH ASHWORTH.

Witnesses:
EDWARD K. DUTTON,
DAVID FULTON.