No. 892,971. PATENTED JULY 7, 1908.

W. M. BLECKER.

ART OF OXIDIZING STEEL SHEETS.

APPLICATION FILED JAN. 20, 1908.

2 SHEETS—SHEET 1.

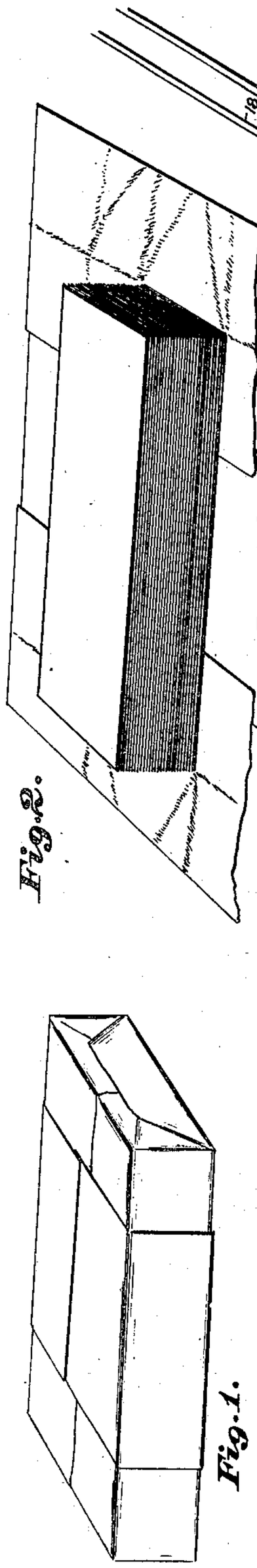
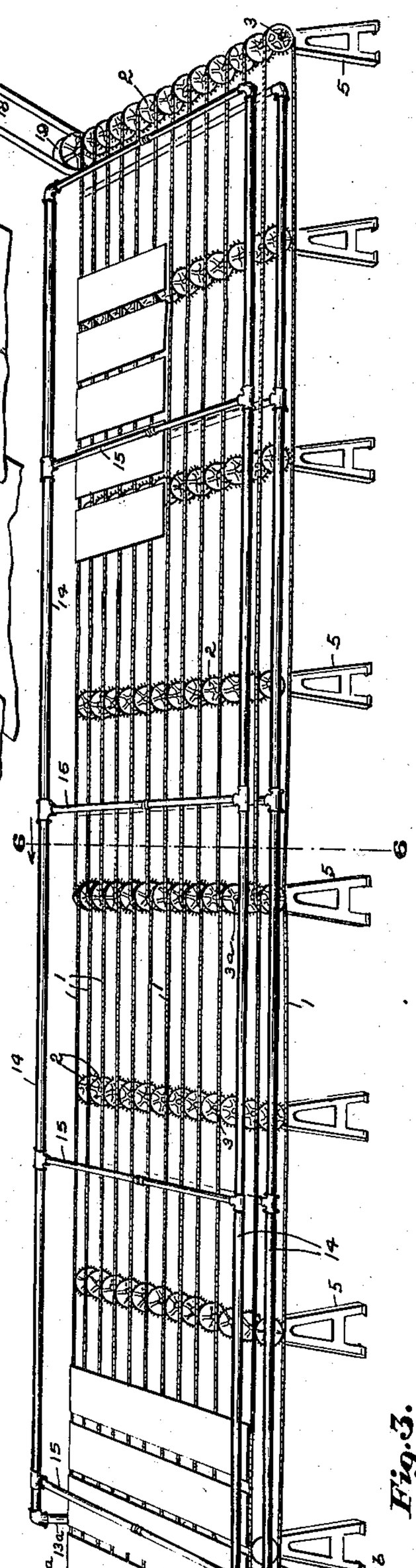


Fig. 2.

Fig. 1.



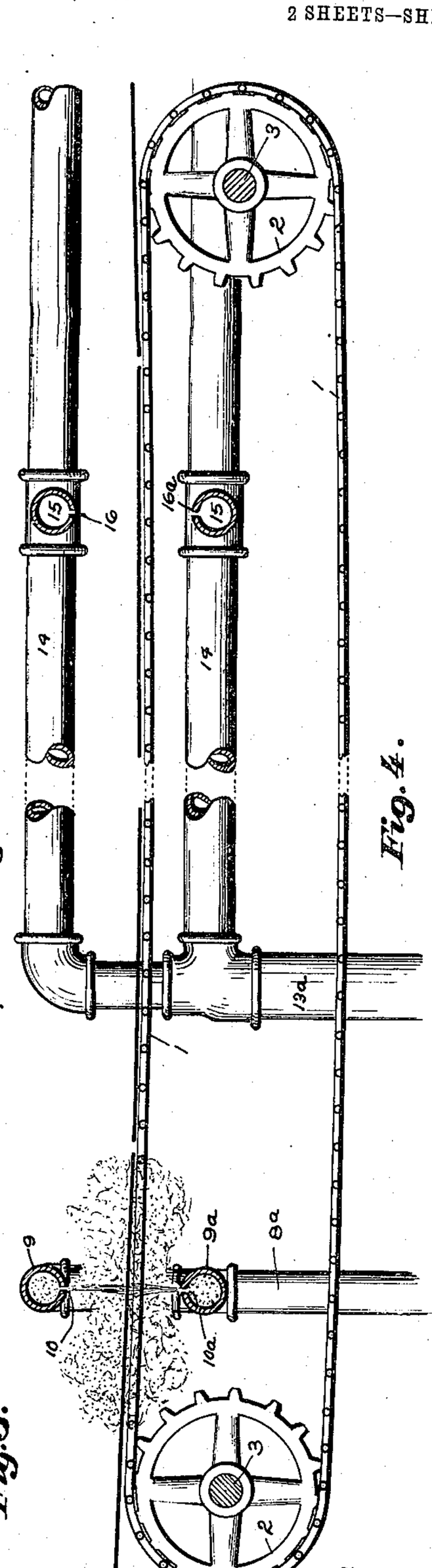


Fig. 4.

Fig. 3.

Witnesses

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2 SHEETS—SHEET 2.

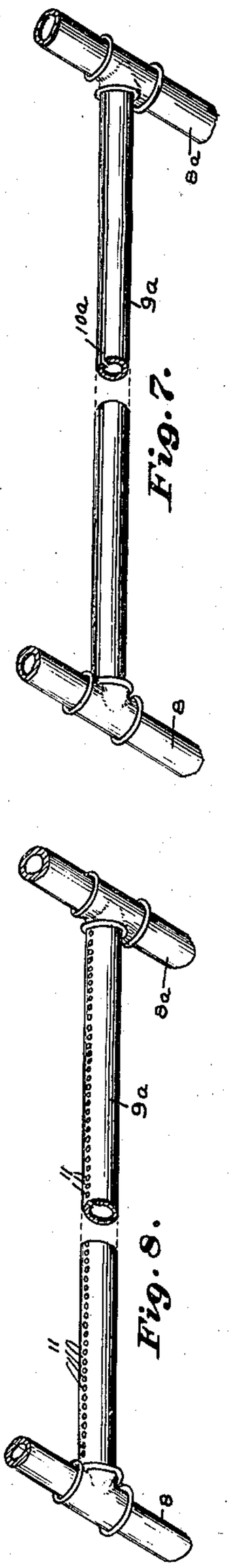

Fig. 7.

Fig. 8.

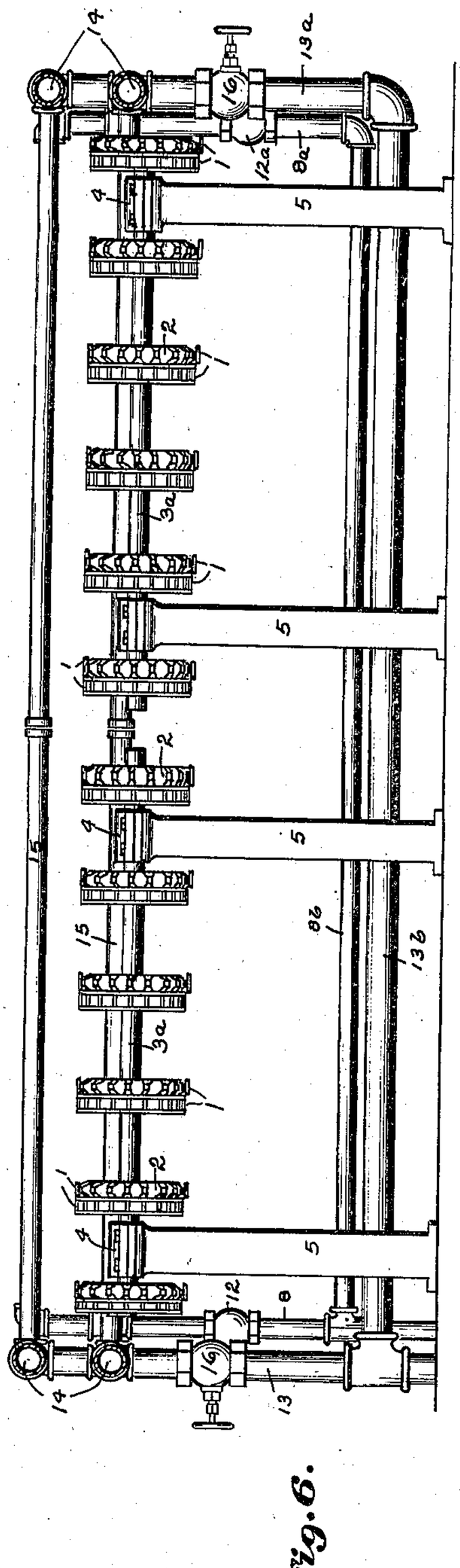

Fig. 6.

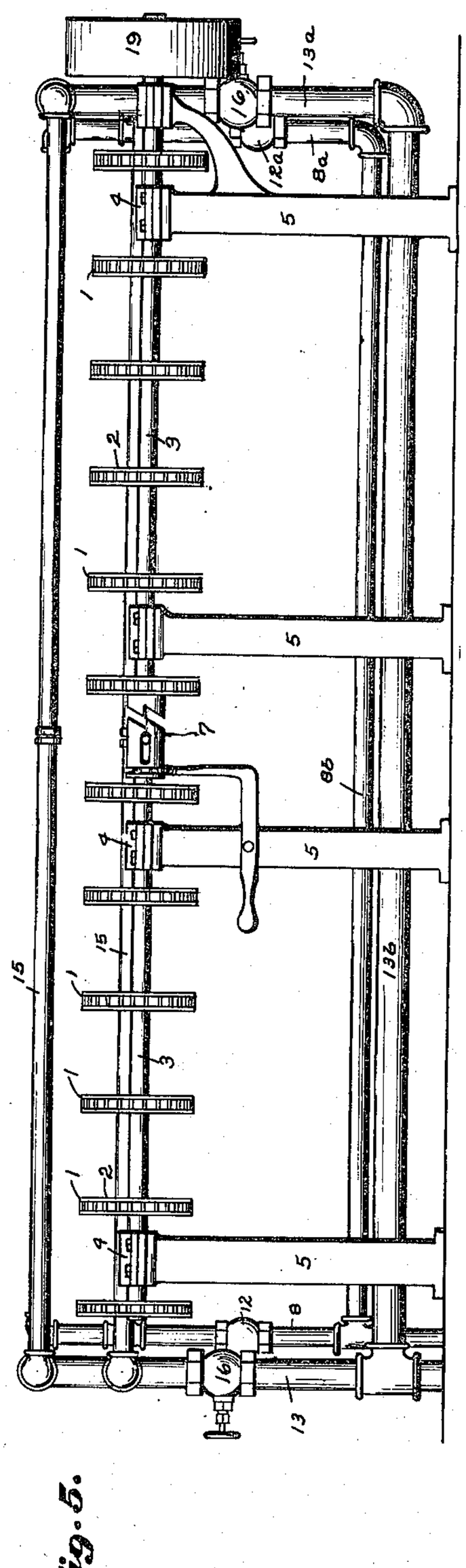

Fig. 5.

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ART OF OXIDIZING STEEL SHEETS.

No. 892,971. Specification of Letters Patent. Patented July 7, 1908.

Application filed January 20, 1908. Serial No. 411,810.

To all whom it may concern:

Be it known that I, WILLIAM M. BLECKER, a citizen of the United States, residing at Canton, in the county of Stark and State of Ohio, have invented a new and useful Improvement in the Art of Oxidizing Steel Sheets, of which the following is a specification.

The invention relates to a method of oxidizing the polished surfaces and cooling the body of ordinarily finished steel sheets as they come from an annealing furnace; and the object of the improvement is to uniformly blue the surfaces of the sheets by a bath of steam followed by one or more baths of cooling air, whereby the oxidation of the surfaces is uniformly completed without impairing the polish or blemishing the bluing thereon, at the same time the body of the sheet is being cooled and the blue color is fixed on the sheets and is not affected by contact with other sheets while being cooled from the heating employed in the annealing process.

In the annealing process, the steel sheets are usually assembled in stacks of uniform size to form a pack which is wrapped or enveloped in other sheets or a suitable case and then placed in a furnace wherein they are brought to a cherry red heat. Upon being removed from the furnace, the envelop or case is opened; and among the methods in common use for bluing the sheets, it is common practice to separate the sheets one from another, either by the use of tongs or by projecting a stream of steam against or along one edge of the sheet, and then to scatter the sheets loosely on a floor or table for cooling. In such a method, it is difficult and practically impossible to bring the oxidizing agent uniformly in contact with the whole of both surfaces of the sheet, and, furthermore, the contact of one sheet against another or of the sheet on the floor or table while being cooled, is apt to blemish the sheet or to prevent a uniform completion of the oxidation by the contact of the air during the somewhat extended period required for cooling the sheets in this manner. These difficulties are avoided and the objects of this invention are attained by the method which is illustrated with reference to a preferred form of apparatus for carrying out the same, in the accompanying drawings, in which

Figure 1 is a perspective view of a pack of sheets enveloped in other sheets for the annealing process; Fig. 2, a perspective view of a pack of sheets opened up ready for the bluing and cooling process; Fig. 3, an outline perspective view of a preferred form of the apparatus employed in the improved process; Fig. 4, an enlarged longitudinal section showing some details of the apparatus; Fig. 5, a rear end view of the apparatus; Fig. 6, a cross-section of the apparatus on line 6—6 Fig. 3; Fig. 7, a fragmentary view of a preferred form of the transverse pipes; and Fig. 8, a perspective view of an alternate form of the same.

Similar numerals refer to similar parts throughout the drawings.

The preferred form of the apparatus which is illustrated, is composed of an endless-chain table, a system of steam pipes, and a system of cooling air pipes. The table is preferably made of the series of endless chains 1, adapted to operate on the series of sprocket wheels 2, securely mounted on the series of shafts 3, which, in turn, are journaled in bearings 4 on the series of standards 5. For general use, the table is preferably made about 75 feet long and some 10 feet wide, and to limit the length of the endless chains for the purpose of conveniently handling and repairing the same, the middle shaft 3^a is preferably provided with a double set of sprocket wheels so that an independent series of chains can be employed in the respective ends of the table. And also, to enable one lateral half of the table to be operated without the other half, when smaller sized sheets are handled thereon, separate shafts are preferably used in each side of the table and the same are adapted to be thrown into and out of gear, as by means of the ordinary clutch 7.

The system of steam pipes is located at the forward end of the table and is composed of the main pipes 8 and 8^a located on the respective sides of the table, the connecting pipe 8^b located below the table, and the transverse pipes 9 and 9^a located immediately above and below the upper sections of the endless chains. The longitudinal slit 10 is provided in the lower side of the transverse pipe 9, and the similar slit 10^a is provided in the upper side of the transverse pipe 9^a, which slits extend from one end to the other of the pipes and are adapted to discharge steam in thin streams. Substantially the same effect can also be accomplished by providing, in each pipe, a longi-

tudinal row of small apertures 11, located quite closely together, as shown in Fig. 8. The supply of steam may be obtained from a boiler or the exhaust of an engine, and the pressure thereof is regulated by suitable valves as 12.

The cooling air system of pipes is composed of the main pipes 13 and 13ª and the longitudinal headers 14, located on the respective sides of the table, the connecting pipe 13ᵇ, and the transverse pipes 15 located immediately above and below the upper sections of the endless chains. The first set of transverse air pipes is located a short distance in rear of the transverse steam pipes, and the successive sets of transverse air pipes are located at intervals apart along the length of the table, the last set being located near the rear end thereof. The longitudinal slits 16 and 16ª are provided in the under and upper sides respectively of the upper and lower transverse air pipes, like the similar slits in the transverse steam pipes, through which slits cooling air is adapted to be discharged in thin streams. The transverse air pipes can be made continuous between the headers from one side to the other, as shown for the transverse steam pipes; but for the purpose of shutting off the air from one side or the other of the table, it is preferable to arrange the pipes on each side of the table in a separate system, as illustrated. The supply of air may be obtained from a compressor or a blower, and the pressure thereof in the respective systems is regulated and controlled by suitable valves as 16. It will be understood that the transverse steam pipes can likewise be divided into lateral sections adapted to be supplied independently of each other, as shown for the transverse air pipes.

Suitable power is applied to the endless-chain gearings, as by means of the belt 18, applied, as shown, to the pulley 19 mounted on the shaft at the rear end of the table; and the same is rotated to cause the upper sections of the endless chains to travel from the front toward the rear of the table. In carrying out the process, the steel sheets are individually removed from the newly-opened packs as they are taken from the annealing furnaces, as by tongs or other suitable means, and are placed on the forward end of the movable table, and are carried by the chains to the rear end thereof. In passing between the upper and lower transverse steam pipes each sheet is impinged by a thin stream of steam, extending uniformly from one end of the sheet to the other, and the movement of the sheet on the table subjects the same to the thin stream of steam quite quickly and uniformly from one edge to the other; so that the entire surface of both sides of the steel sheet is subjected to a bath of steam which is uniformly applied from end to end, and substantially instantaneously applied from edge to edge, whereby a uniform oxidation of the whole surface of both sides of the sheet is accomplished. As the sheets are carried rearward on the movable table by the endless chains, they will be subjected successively to similar baths of cooling air, which is discharged from the respective sets of transverse air pipes, whereby the oxidation caused by the steam bath will be uniformly completed and permanently fixed and the sheets will be uniformly and quite rapidly cooled by the time they reach the rear end of the table, from which they are adapted to be taken and removed as by tongs or other suitable appliance.

It is evident that by oxidizing the sheets on both sides by a uniform and substantially instantaneous bath of steam, the oxidation will be accomplished uniformly over the whole surface of both sides of the sheets, and that by cooling the sheets as they are carried rearward by the endless chains, the whole surface of both sides of the sheets will be uniformly and simultaneously subjected to successive baths of cooling air, intermediate which they will also be uniformly exposed to the ordinary atmosphere, until they are completely cooled at the rear end of the table; and that in the whole process the sheets are kept entirely separate, without contact with one another, or with the surface of a supporting floor or table, excepting only the contact of the endless chains, which is a negligible contact because it is limited to a very few points on the under side of the sheet.

It is evident that instead of employing steam, as described for oxidizing the sheets, the essential nature of the process will not be affected by using spray or some other form of aqueous vapor for the same purpose; and it is furthermore evident that when it is desired to oxidize the sheet on one side only, the impinging streams of steam and air can be omitted on the other side of the sheet.

The apparatus which is illustrated and described but not claimed herein, for carrying out the process which is the subject-matter of this application, is made the subject matter of another application for Letters Patent filed herewith, Serial No. 411,809.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The process of oxidizing a hot steel sheet, consisting in passing it between impinging streams of steam extending transversely across the sheet, and then passing it between a series of similar impinging streams of cooling air.

2. The process of oxidizing a hot steel sheet, consisting in passing it between impinging streams of steam extending transversely across the sheet, and then passing it between similar impinging streams of cooling air.

3. In oxidizing a hot steel sheet, the process of passing it between impinging streams of steam extending transversely across the sheet.

4. The process of oxidizing a hot steel sheet, consisting in impinging its face continuously from one edge to another with a stream of steam extending transversely across the sheet, and then impinging it in the same manner with a series of similar streams of cooling air.

5. The process of oxidizing a hot steel sheet, consisting in impinging its face continuously from one edge to another with a stream of steam extending transversely across the sheet, and then impinging it in the same manner with a similar stream of cooling air.

6. The process of oxidizing a hot steel sheet, consisting in passing it between impinging streams of aqueous vapor extending transversely across the sheet, and then passing it between a series of similar impinging streams of cooling air.

7. The process of oxidizing a hot steel sheet, consisting in passing it between impinging streams of aqueous vapor extending transversely across the sheet, and then passing it between similar impinging streams of cooling air.

8. In oxidizing a hot steel sheet, the process of passing it between impinging streams of aqueous vapor extending transversely across the sheet.

9. The process of oxidizing a hot steel sheet, consisting in impinging its face continuously from one edge to another with a stream of aqueous vapor extending transversely across the sheet, and then impinging it in the same manner with a series of similar streams of cooling air.

10. The process of oxidizing a hot steel sheet, consisting in impinging its face continuously from one edge to another with a stream of aqueous vapor extending transversely across the sheet, and then impinging it in the same manner with a similar stream of cooling air.

WILLIAM M. BLECKER.

Witnesses:
JOSEPH FREASE,
HARRY FREASE.