No. 626,847. Patented June 13, 1899.

W. M. THEOBALD.

MANUFACTURE OF SHEET METAL

(Application filed Feb. 23, 1899.)

(No Model.)

Fig. 3.

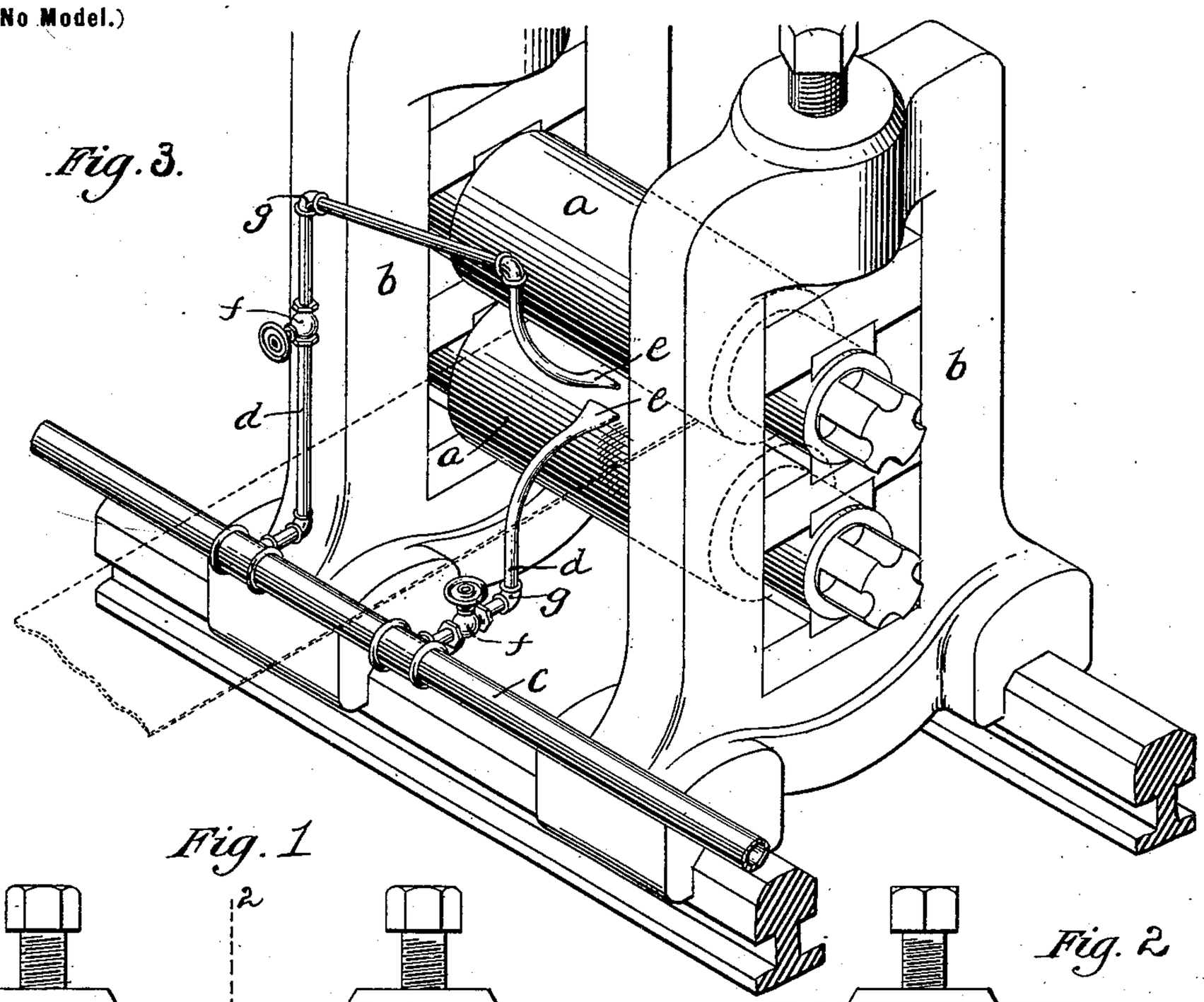


Fig. 1

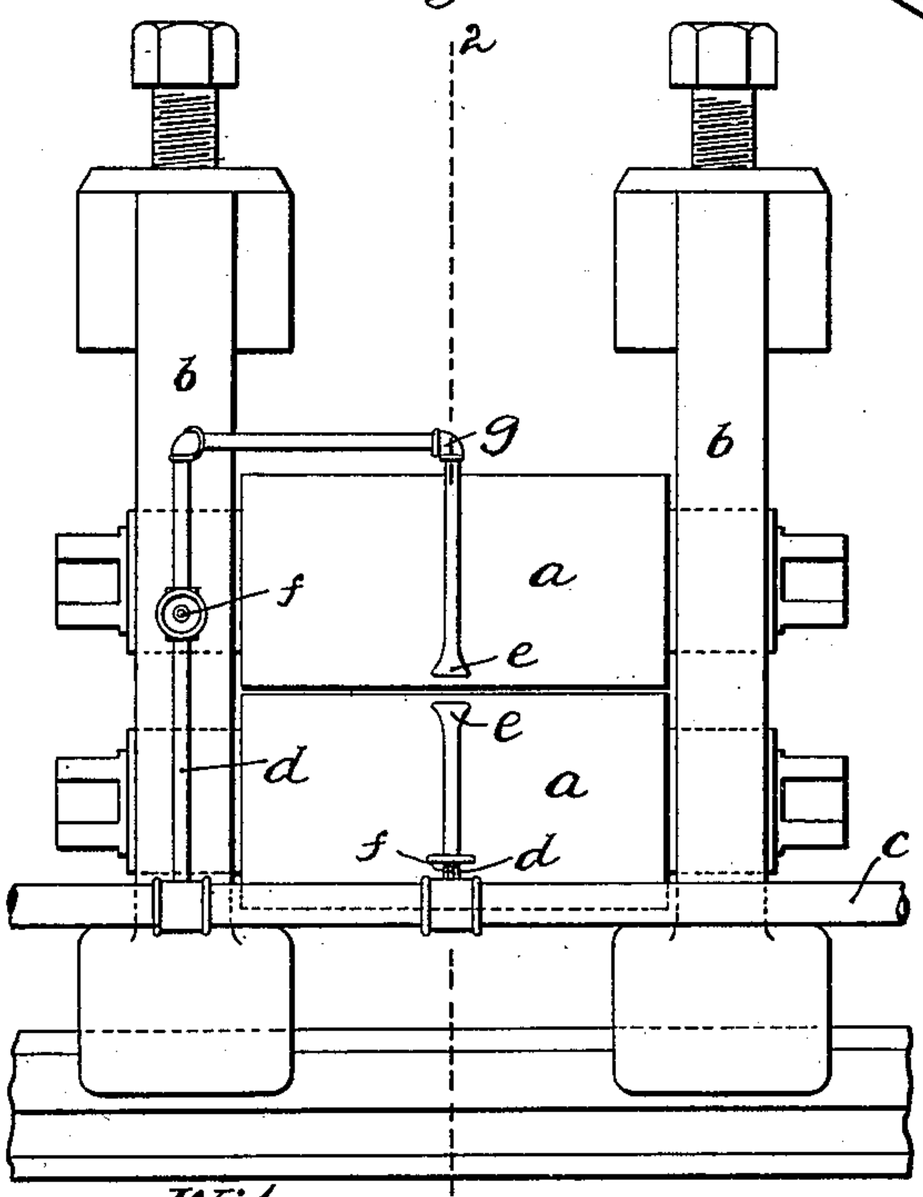
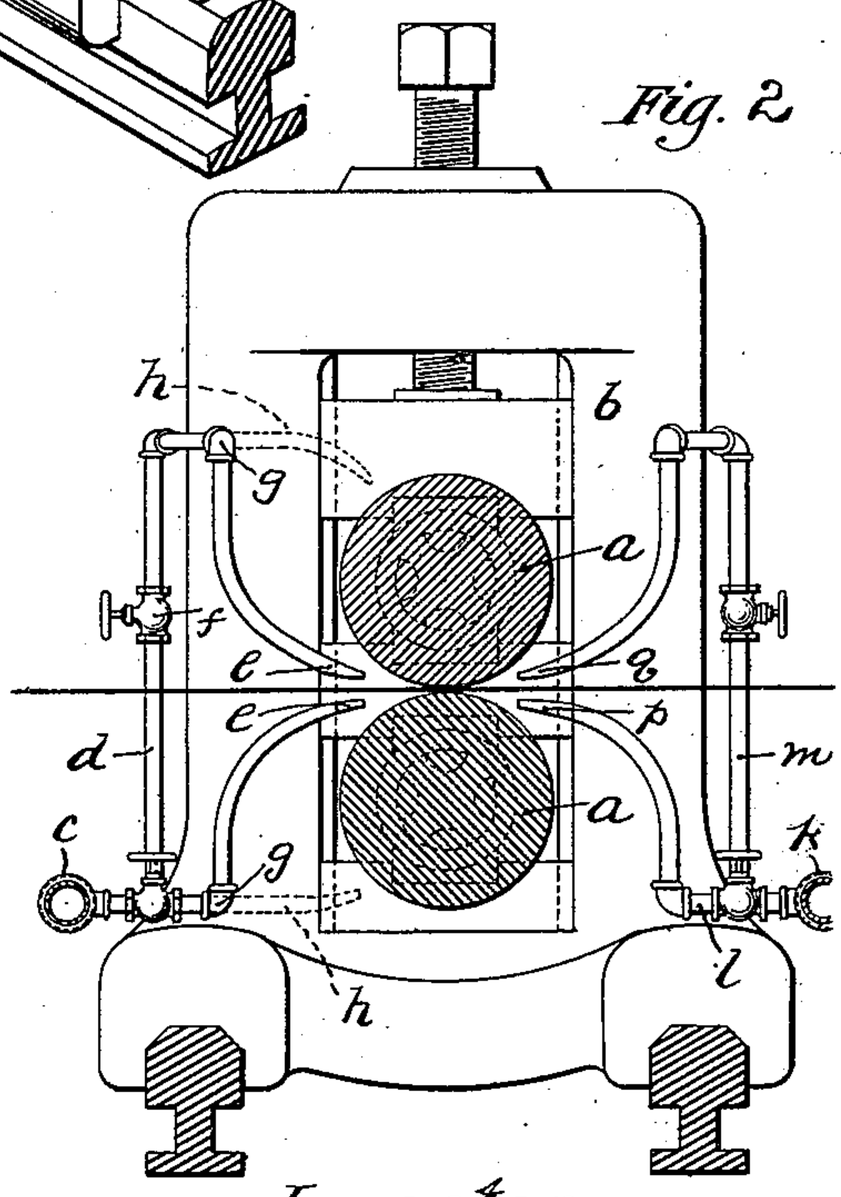


Fig. 2



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MANUFACTURE OF SHEET METAL.

SPECIFICATION forming part of Letters Patent No. 626,847, dated June 13, 1899.

Application filed February 23, 1899. Serial No. 706,521. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM M. THEOBALD, a resident of Wellsville, in the county of Columbiana and State of Ohio, have invented a new and useful Improvement in the Manufacture of Sheet Metal; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to the manufacture of sheet metal; its object being to provide for the formation of an even or practically uniform surfacing of oxid on iron or steel sheets and for the production of sheet metal generally of even gage.

In the manufacture of what is known as "polished" sheet iron or steel it is desirable to form on the sheets as a permanent durable surface a peculiar oxid coating known as a "blue" oxid. It has been found that to produce this result it is desirable to roll the sheets at a certain temperature when the sheets are, as might be termed, "warm" rather than "hot," being between, say, 300° and 900° Fahrenheit, the sheets being passed between smooth-surface or polished rolls after exposure of the sheets to the atmosphere and while at approximately such temperature, so that the oxid formed will adhere permanently to the sheets. One difficulty experienced in this art has been that the edge portions of the sheets would be more exposed to atmospheric influences than the mid-portions thereof, and therefore a thicker coating of oxid formed on such edge portions, and another difficulty has been found in the fact that the heated sheets gradually heat up and expand the portions of the rolls through which they are passed, and the rolls therefore lose their exact parallelism, the center portions being then of greater diameter than the end portions, which leads, especially in the rolling of single sheets, which is necessary in forming this polished sheet metal, to the rolling of the center portions of the sheets thinner than the edge portions, causing the buckling of the sheets and rendering them unfit for use. Though the practice has been to turn the rolls slightly concave—that is, of less diameter in the center portions than at the end portions—to allow for this heating and consequent enlargement, it has been found difficult even then to maintain an even diameter, and in the rolling of a charge of such sheets received from the annealing-furnace it has been frequently necessary to interrupt the rolling operation one or more times in rolling such charge to permit the cooling of the rolls. When the rolls are set close, as in rolling small sheets or packs of thin gages, this expansion forces the under portions of the two rolls into such contact as to cut and destroy the polished surfaces, forming what are termed "whiskers." This prevents the production of smooth sheets and makes it necessary to frequently turn and polish the roll-faces. The practice for cooling the rolls heretofore followed has been to project a stream of water or air upon the face of one or both rolls for the entire length thereof; but such water-cooling could not be employed in forming this polished sheet metal, while either air or water cooling, as so applied, has not given the desired result, for the reason that it extended for the full length of the rolls. Attempt has been made to heat the middle portions of the rolls, so as to bring them up to proper gage for rolling the sheets; but this would simply aggravate the difficulty which it is the object of the present invention to overcome. By the present invention I am enabled not only to provide for the more even oxidizing of the sheets themselves, but to maintain the rolls of even diameter, and therefore to roll the sheets of even thickness and prevent buckling. It consists, generally stated, in passing the sheets while heated between smooth-surface rolls and at the same time projecting a current of cold air against that middle portion of the working faces of the rolls liable to be expanded as a result of contact with the hot sheets, and thereby maintaining the rolls of even diameter throughout, the current of cold air also serving, if necessary or desirable, to oxidize or increase the oxidation of the mid-portions of the sheets, and thereby bring such mid-portions to or approximately to the same condition as regards oxidation as the edge portions, and therefore produce a more even and regular surface of oxid on the entire sheet.

To enable others skilled in the art to practice my invention, I will describe the same more fully, referring to the accompanying drawings, in which—

Figure 1 is a face view of the rolls suitable for practicing the invention, and Fig. 2 a cross-section of the same. Fig. 3 is a detailed perspective view and illustrating the passage of the sheet through the rolls.

Like letters of reference indicate like parts in each of the views.

For the practice of the invention I employ the ordinary smooth-faced rolls, which are preferably polished to form a more perfect surface on the sheets. The drawings illustrate the two rolls *a a* mounted in suitable housings *b b* and also shows in all the figures the air-supply pipe *c*, from which the branch pipe *d* leads off in position for its nozzle *e* to play upon the rolls, this branch pipe being controlled by a suitable valve *f*. The mouth of the nozzle is preferably flattened, as shown, to deliver a broad thin stream of air upon the middle portion of the rolls. This nozzle may be connected to the branch pipe by a rotating joint, as at *g*, or it may be arranged, such as by a change of nozzles, as indicated at *h*, Fig. 2, to play upon other parts of the roll—that is, away from the line of bite—such as upon the bottom of the same. I find, however, the most convenient point on which to project the current of air to be at or near the line of bite between the two rolls, so that the one nozzle serves to play upon the mid-portions of both rolls at the same time. If desired, as illustrated, a second nozzle may be employed to project the air-current downwardly upon the top face of the passing sheet, while the nozzle *e* projects the current upwardly against the bottom face of the same, this having advantages in securing the uniform oxidizing of the sheets above referred to. As the temperature of the mid-portions of the rolls can be reduced by the air-blast and their diameters actually and perfectly controlled, the rolls are preferably formed of practically even diameter throughout, the necessity for concaving them on account of the heating of the mid-portions by the hot metal on which they operate being overcome. Indeed, the rolls may be very slightly convex to compensate for the heating of the end portions by friction upon their necks.

In the practice of the invention for the manufacture of polished iron or steel sheets the sheets to be treated are annealed in the ordinary way, a pile of such sheets being inclosed within the ordinary annealing-box and subjected to an annealing heat within an annealing-furnace and the box withdrawn at the proper time and when the sheets are at the proper temperature the box opened and the sheets exposed to contact with the atmosphere. The usual practice in so doing is to remove the annealing-box, and when the sheets are at the proper heat expose them one by one to the atmosphere by turning them over onto a supporting-truck. Though this exposes all of the surface of each sheet to the atmosphere as they are piled on the truck, it is evident that the air can penetrate more freely between the edges, which leads to the formation of a somewhat heavier oxid in the edge portions than in the mid-portions of the sheets. The sheets are then taken to the rolls and while heated are passed separately through the rolls to fix or fasten the oxid-surfacing so formed permanently to the sheets and as they are passed through the current of cold air plays upon the mid-portions of the rolls, and as it is projected upon the mid-portions of the sheets passing through the rolls it will cause a more active oxidation of such portions, and therefore lead to a more even surfacing of oxid, compensating for the exposure of the edge portions of the sheets before their passage through the rolls. The current of air so playing upon the mid-portions of the rolls will also at the same time cool the particular portions of the roll contacting directly with the warm metal sheets, which are generally passed through the rolls at a temperature between 300° and 900° Fahrenheit, and by cooling these mid-portions of the rolls hold the rolls to even diameter in the working portions, preventing expansion of such mid-portions and so insuring the even rolling of the sheets, so that the difficulty of buckling the sheets above described is entirely overcome. The operator can easily regulate the current of cold air according to the heat of the sheets passing through, so as to hold the rolls to exact diameters. By "cold air" I mean at or approximately at normal atmospheric temperature; but where comparatively high heats are employed in the sheets the air may, especially in hot weather, be artificially cooled, if so desired.

In the making of such polished sheet iron or steel of heavy gage it is found that when rolled at the proper temperature for securing the oxid to the surface of the sheets the sheets after passing through the rolls may not be sufficiently cooled to be piled without injury to the finished sheets, but that the center portions of the sheets in the pile of finished sheets are liable to be affected by the heat so as to injure the polished surfaces produced. In order to overcome this difficulty, in addition to the pipes providing for projecting the current of cold air upon the mid-portion of the sheets before passing into the rolls I may provide like pipes arranged to project a like current upon the mid-portions of the sheets passing from the rolls, and thereby to lower the temperature of the mid-portions of these heavy sheets sufficiently to prevent such action when they are piled together. For this purpose I may provide the air-supply pipe *k* on the rear side of the roll-housing with valve-controlled branch pipes *l* or *m*, leading therefrom and provided with nozzles *p* or *q*, adapted to play upon the mid-portions of the sheets either on the top or bottom faces thereof or on both as they pass from the rolls. When these additional air-supply pipes are employed, as the sheet passes from the rolls the air-blast will strike upon the mid-portions thereof, and

thereby aid in cooling those portions, so that these heavy sheets can be safely piled or stacked immediately after passing from the rolls.

The invention has advantages even though employed in the rolling of heavier sheets or of packs of sheets of any metal in course of manufacture as distinguished from the finishing of polished iron or steel sheets, and whether the sheets are either simply warm or more highly heated in insuring exact gage of metal produced and overcoming the necessity of the water-cooling of the rolls, which is often injurious both to the rolls and to the metal passing through them.

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

1. The method of rolling sheet metal and maintaining the rolls of proper diameter for rolling, consisting in passing the sheets while heated between smooth-surface rolls, and at the same time projecting a current of cold air against the mid-portion only of the working surface of the rolls and thereby maintaining the rolls at even diameter throughout.

2. The method of forming sheet iron or steel, consisting in annealing the sheets, oxidizing the same by exposure to the atmosphere and passing the sheets while heated between smooth-surface rolls and projecting a current of cold air against the mid-portions only of the sheets while passing through the rolls.

3. The method of rolling sheet metal, consisting in passing the sheets while heated between smooth-surface rolls and at the same time projecting a current of cold air against the mid-portions of the sheets or rolls on the entering side thereof and a current of cold air on the mid-portions of the sheets after they pass from the rolls.

4. The method of maintaining heated sheet-rolls at the proper diameter for rolling, consisting in projecting a current of cold air against the mid-portions only of the rolls.

5. In combination with a pair of sheet-rolls having working faces of substantially even diameter throughout, an air-jet mechanism suitably arranged for projecting a supply of cold air against the mid-portion only of either roll, substantially as described.

6. In combination with a pair of sheet-rolls having working faces of substantially even diameter throughout, an air-jet mechanism located on the entrance side of the rolls, and an air-jet mechanism on the delivery side of the rolls, each air-jet mechanism being arranged for projecting a supply of cold air midway only of the length of the rolls and upon the sheets as they pass through the same, substantially as described.

In testimony whereof I, the said WILLIAM M. THEOBALD, have hereunto set my hand.

WILLIAM M. THEOBALD.

Witnesses:
JAMES I. KAY,
ROBERT C. TOTTEN.