S. M. COCKBURN.

BOILER TUBE CLEANER.

APPLICATION FILED APR. 14, 1905.

928,361.

Patented July 20, 1909.

3 SHEETS—SHEET 1.

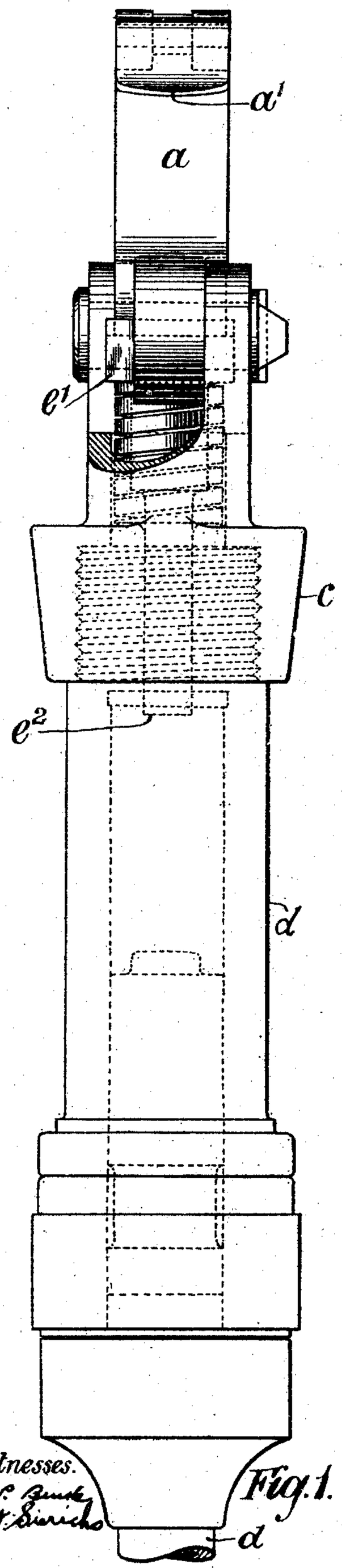

Fig. 1.

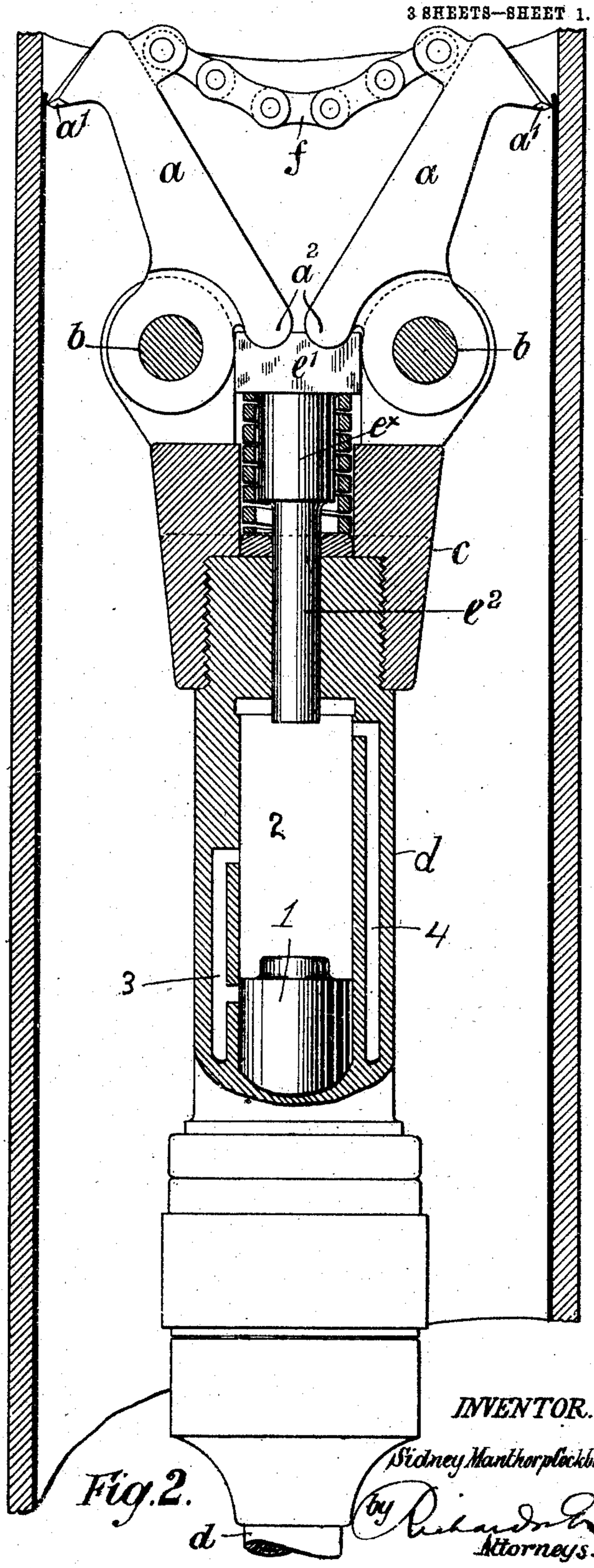

Fig. 2.

Witnesses.
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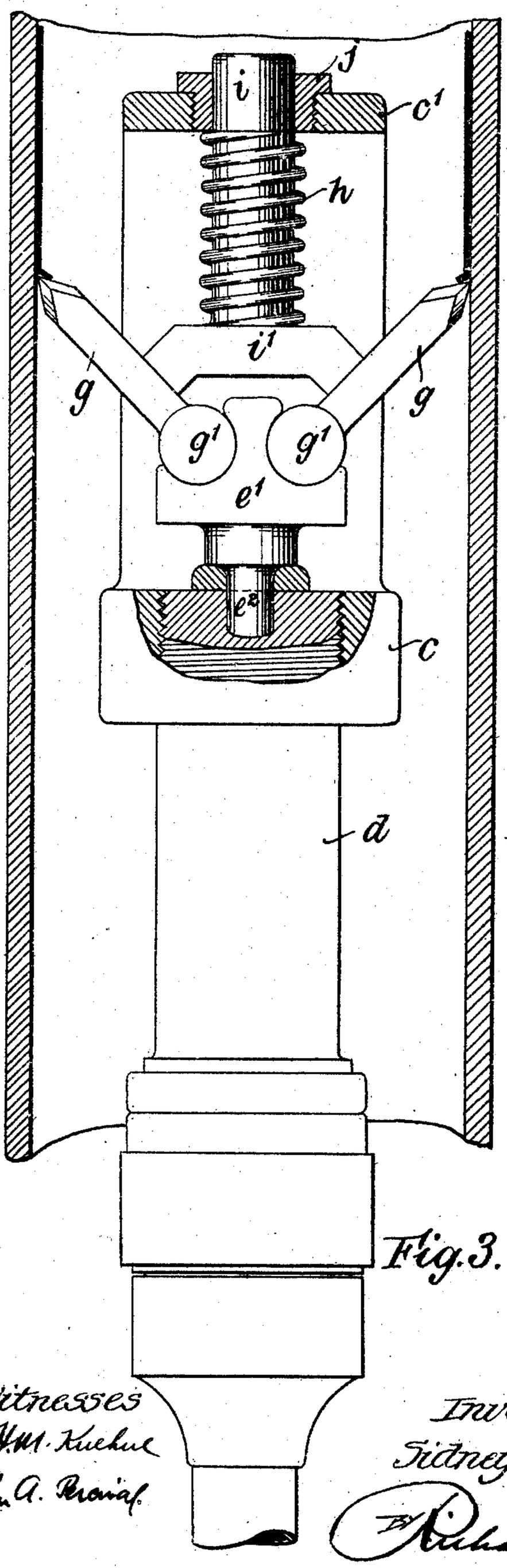

Fig. 3.

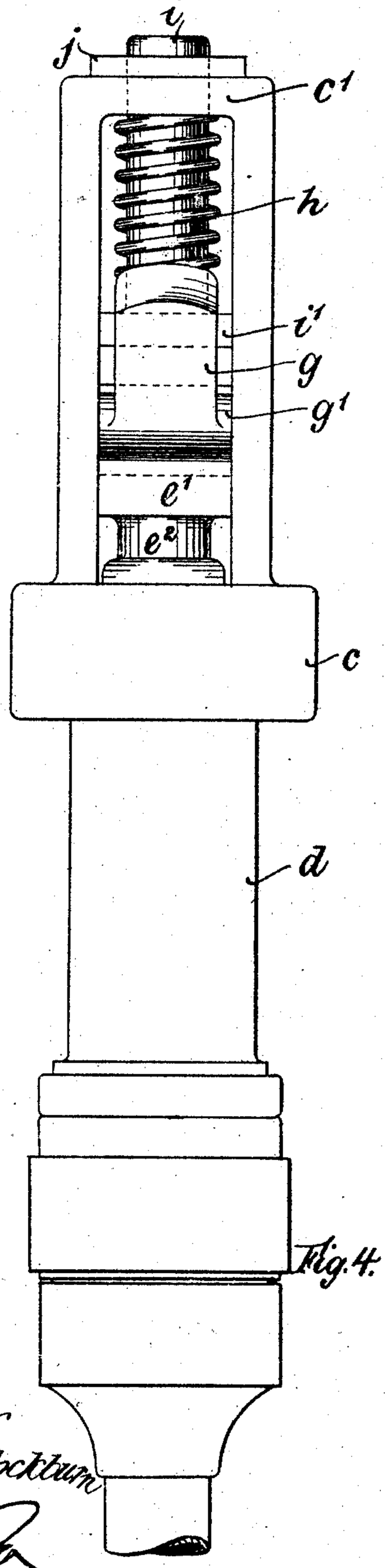

Fig. 4.

Witnesses
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3 SHEETS—SHEET 3.

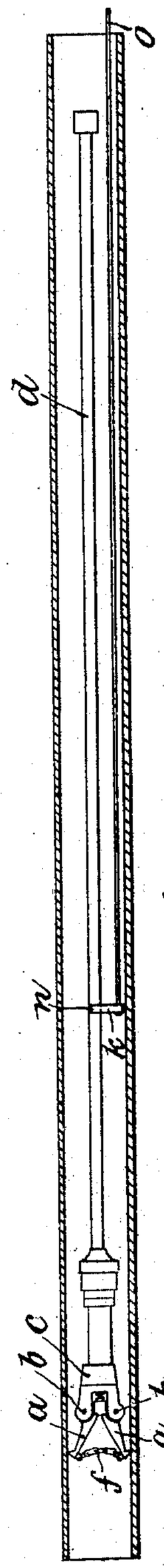

Fig. 5.

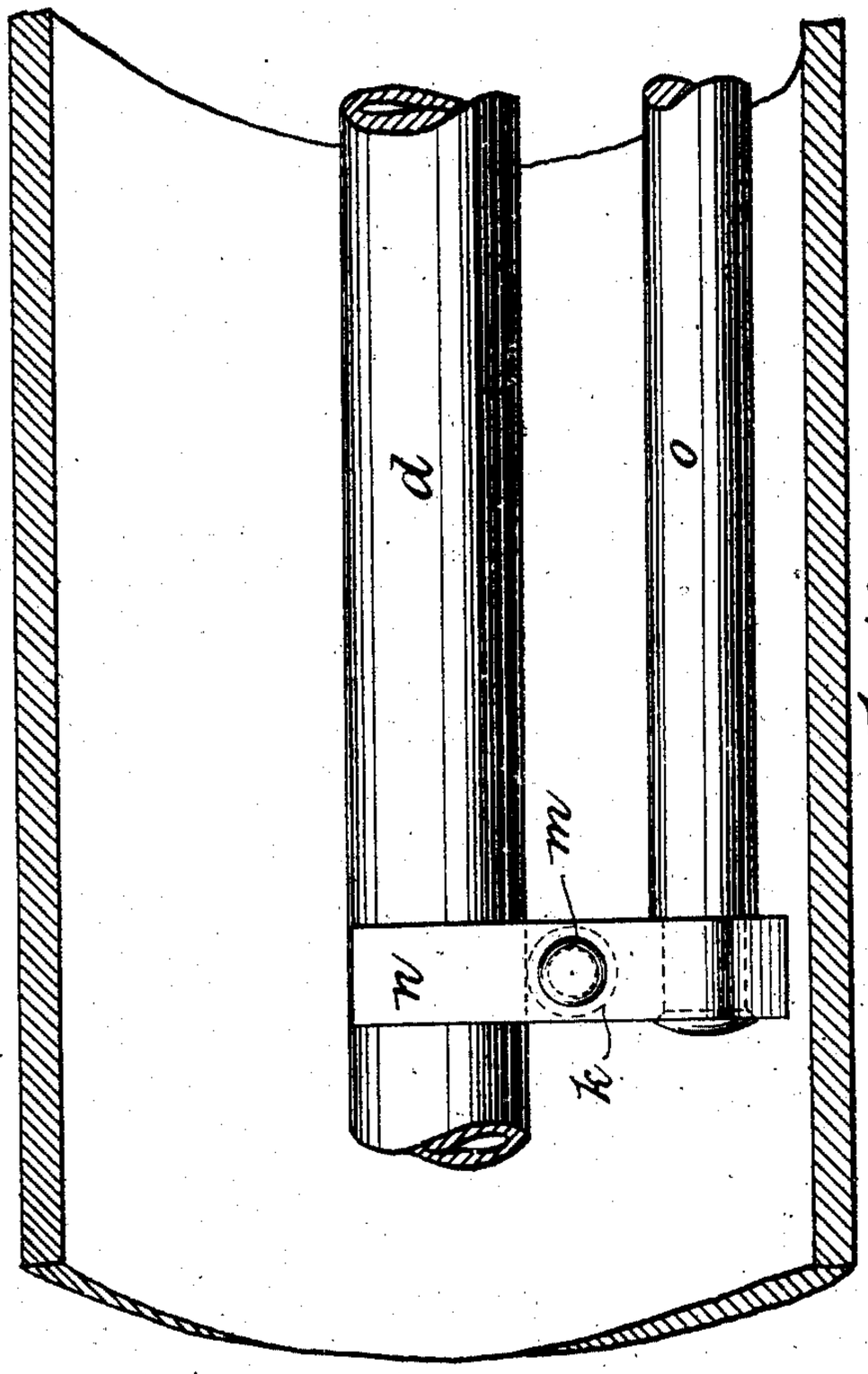

Fig. 4.

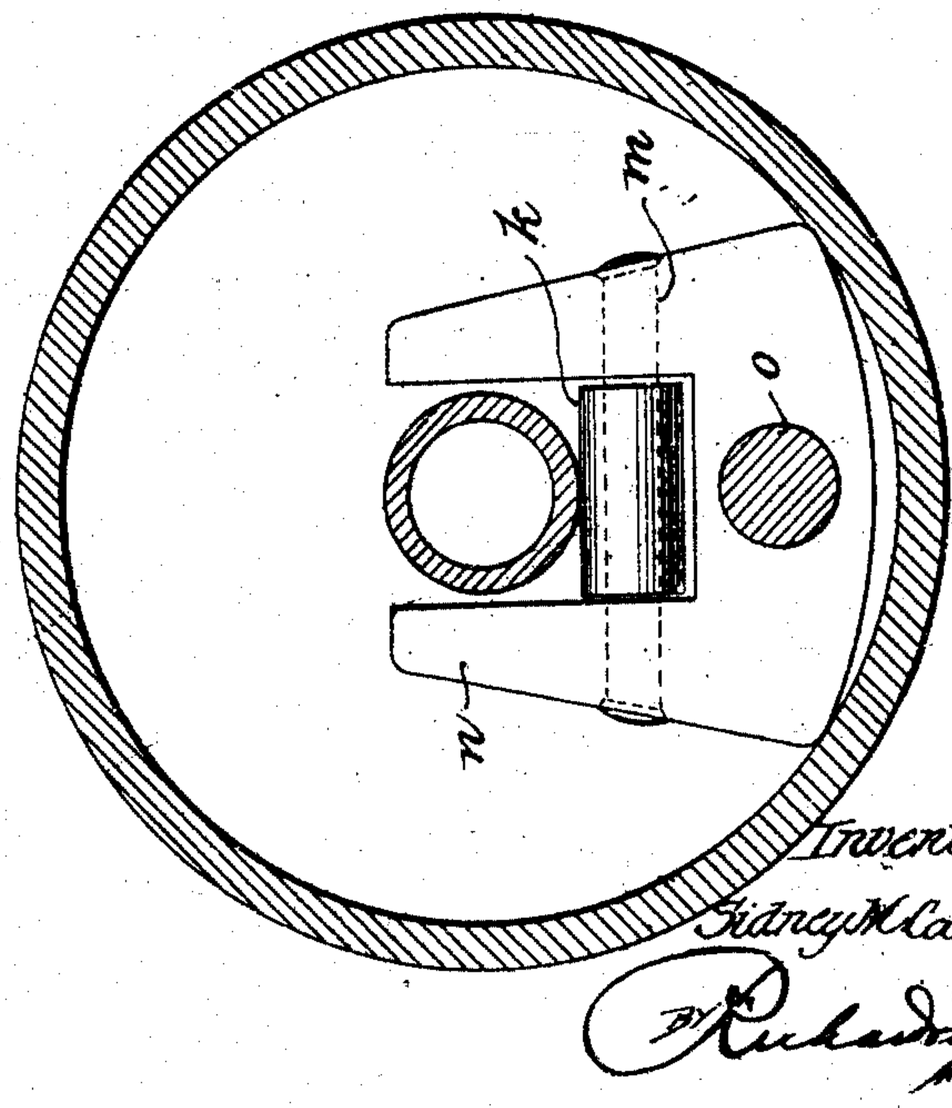

Fig. 6.

Witnesses

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John A. Percival.

Inventor

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Attys

UNITED STATES PATENT OFFICE.

SIDNEY MANTHORP COCKBURN, OF LONDON, ENGLAND.

BOILER-TUBE CLEANER.

No. 928,361. Specification of Letters Patent. Patented July 20, 1909.

Application filed April 14, 1905. Serial No. 255,616.

To all whom it may concern:

Be it known that I, SIDNEY MANTHORP COCKBURN, subject of the King of Great Britain, residing at 72 Bishopsgate street Within, in the city of London, England, have invented a new and useful Boiler-Tube Cleaner, of which the following is a specification.

This invention relates to a contrivance for breaking and removing the incrustation which adheres to the interior surface of tubes, particularly the tubes of water-tube boilers.

The contrivance is mechanically operated, preferably by pneumatic power, though, when such power is not available, steam, electrical or other power may be utilized.

The contrivance is secured to the end of an arm which carries a hammer, preferably a pneumatic hammer which is adapted to automatically deliver a rapid succession of blows, the scaling contrivance and operating device, carried on the arm, being adapted to be inserted through the door, which is normally provided at the end of each of the tubes of the boiler, and moved throughout the length of the tubes, and rotated relatively thereto.

The principle of operation consists in maintaining an edged tool in pressure contact with the incrustation which is required to be removed and causing it to receive a succession of blows whereby the incrustation will be chipped off in small portions.

In other previous contrivances for removing incrustation in which the edges of the tools are held in contact therewith, the arrangements are such that the energy of the blow of the hammer is adapted to exert a crushing force on the incrustation by applying to the tool a force in a wedge-like manner. In such an action the longitudinal movement of the wedge through a relatively long distance, occupying an appreciable interval of time, robs the blow of its impulsive character and renders the tool very inefficient in dealing with material of a brittle nature for it tends to crush the incrustation more or less to powder instead of effecting a clean cleavage of successive fragments from the surface of the metal by impact concentrated into a minimum time-and-space interval. Moreover the frictional sliding of the wedge surfaces on one another will absorb energy and correspondingly still further damp the percussive action of the blow and diminish the efficiency of the operation.

The accompanying drawings show two forms of construction whereby the scaling operation can be effected according to my invention.

Figures 1 and 2 show an arrangement in which the scaling tools are so mounted that their edges are caused to press normally on the surface of the scale, and on receiving a blow to penetrate the scale which, being of a brittle nature will, on being laterally displaced by the thickness of the penetrating portion of the tool, detach itself in small portions from the metal of the tube. Figs. 3 and 4 show an alternative method of action in which the edge of the tools are pressed obliquely against the incrustation at the place where it is attached to the metal of the tube, the tools being so mounted that, on receiving the succession of hammer blows, the separating edges are wedged between the scale and the metal and act in a manner like that of an engineer's chisel in performing the separation by a chipping operation. Figs. 5, 6 and 7 show how the scaling tool is supported within a tube and so manipulated as to act successively on every part of the internal surface.

Referring to Figs. 1 and 2, *a a* are two scaling tools oppositely pivoted at *b b* on a socket *c* which is secured to a tubular arm *d* which contains the pneumatic hammer 1, reciprocated in the chamber 2 by means of fluid under pressure introduced through ports 3 and 4. By this means the tool is manipulated and caused to effect the desired result at every part of the internal surface of the tube. The pivoted tool *a* is provided with a portion extending from the pivot in the direction of the length of the tube, said portion having a round shaped chisel edge a^1 and the tool *a* is further provided with a portion extending transversely to the tube and having a semi-cylindrical heel a^2 which is seated in a corresponding recess formed in the end surface of the head e^1 of a drift e^x, the shank e^2 of which is adapted to receive the rapid succession of blows delivered by a pneumatic hammer 1. Between the shank of the drift and the internal surface of the socket *c* a helical spring under compression is inserted under the head e^1 of the drift, which spring will serve to press the edge a^1 of the tool into contact with the incrustation so that, when the blow is struck on the

drift, only a small movement of the portion of the tool which receives the blow will be requisite to effect penetration and cause the separation of the incrustation. The heel of the tool which receives the blow and the drift which serves as the agent for delivering the blow both move in the direction of the momentum of the hammer and the distance they are permitted to move being so little, and the time interval occupied in the movement being so short, the percussive effect of the blow is correspondingly enhanced and also a minimum amount of the energy of the blow is expended in giving velocity to the moving parts. A chain *f* may be employed to limit the outward extension of the tools when out of operation, but this is unimportant.

Referring to Figs. 3 and 4, a modification is shown whereby the chisel edges operate to separate the incrustation from the metal to which it is adherent:—But in this arrangement as in the former, the success of the operation depends on the maintenance of a pressure contact of the edges of the tools with the incrustation to be separated and on the blow being received by a portion of the tool which moves in the same direction as the agent which delivers the blow. In this construction the chisels *g g* are pivoted at g^1 g^1 in cylindrical recesses formed in the drift head e^1 and are forced into contact with the metal of the tube by means of the helical spring *h* which is interposed between the head c^1 of the socket *c* and the foot i^1 of a presser *i* which is guided in a bush *j* which is screwed into the head c^1 of the socket. By means of the tubular arm *d* the chisel edges are kept up to their work in contact with the incrustation, and each blow delivered on the shank e^2 of the drift causes the breaking away of an additional small portion of the scale.

Fig. 5 is a small scale general view showing the contrivance mounted on a centering rest in such a way that it can be moved lengthwise along the tube to be cleaned or turned relatively thereto with facility.

The details of the construction of the centering rest are shown in Figs. 6 and 7 in which it will be seen that the tubular arm *d* rests on a roller *k* which is mounted on a pin *m* carried in a rest *n* which, by means of a rod *o* can be shifted into any required position.

I claim.

1. Apparatus for effecting the separation of incrustation from the interior surface of a tube, comprising a carrier adapted to be inserted within the tube, an edged tool mounted on the carrier, means for striking a succession of blows, a drift for transmitting the blows to a portion of the tool which moves in the same direction as the drift and a spring for maintaining the drift in pressure contact with the tool and the edge of the tool with the incrustation during the entire operation of the apparatus.

2. Apparatus for effecting the separation of incrustation from the interior surface of a tube, comprising a carrier adapted to be inserted within the tube, an edged tool supported by the carrier in a pivoted manner, a drift, guided within the carrier, having a portion of the tool seated therein constrained to move in the same direction as the drift, a spring for maintaining the drift in pressure contact with the tool and the edge of the tool with the incrustation during the entire operation of the apparatus and means for striking a succession of blows on the drift.

3. Apparatus for effecting the separation of incrustation from the interior surface of a tube, comprising a carrier adapted to be inserted within the tube, a tool pivotally mounted on the carrier, said tool having an edge-ended portion extending from the pivot in the direction of the length of the tube and a portion extending from the first mentioned portion transversely to the tube, a coiled spring for maintaining the edge of the tool in pressure contact with the incrustation during the entire operation of the apparatus and means for imparting a succession of blows to the transversely extending portion of the tool.

4. Apparatus for effecting the separation of incrustation from the interior surface of a tube, comprising a carrier adapted to be inserted within the tube, a tool pivotally mounted on the carrier, said tool having an edge-ended portion extending from the pivot in the direction of the length of the tube and a portion extending transversely to the tube having a heel at the end thereof, means for striking a succession of blows, a drift for transmitting the blows to the heel and a spring abutting directly on the drift and thereby maintaining the edge of the tool in pressure contact with the incrustation during the entire operation of the apparatus.

5. Apparatus for effecting the separation of incrustation from the interior surface of a tube, comprising a carrier adapted to be inserted within the tube, an edged tool supported by the carrier in a pivoted manner, a drift, guided within the carrier, having an end recess wherein a portion of the tool constrained to move in the same direction as the drift is seated, a spring for maintaining the drift in pressure contact with the tool and the edge of the tool with the incrustation during the entire operation of the apparatus, and means for striking a succession of blows on the drift.

6. Apparatus for effecting the separation of incrustation from the interior surface of a tube, comprising a carrier adapted to be inserted within the tube, a tool pivotally mounted on the carrier, said tool having an

edge-ended portion extending from the pivot in the direction of the length of the tube and a portion extending transversely to the tube having a heel at the end thereof, means for striking a succession of blows, a drift for transmitting the blows to the heel and having an end recess wherein said heel is seated and a spring abutting directly on the drift and thereby maintaining the edge of the tool in pressure contact with the incrustation during the entire operation of the apparatus.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

SIDNEY MANTHORP COCKBURN.

Witnesses:

ROBERT ALFRED BLAKE,

WALTER J. SKERTEN.