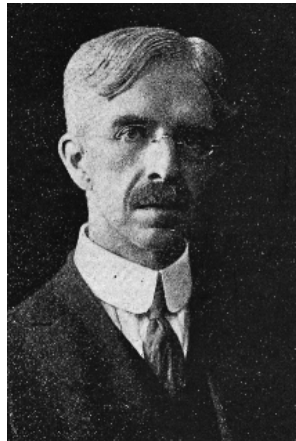


# Who Invented Activated Sludge?



Daniel Schneider

Department of Urban and Regional Planning

University of Illinois at Urbana-Champaign

# HYBRID NATURE

Sewage Treatment and  
the Contradictions of the  
Industrial Ecosystem

DANIEL SCHNEIDER



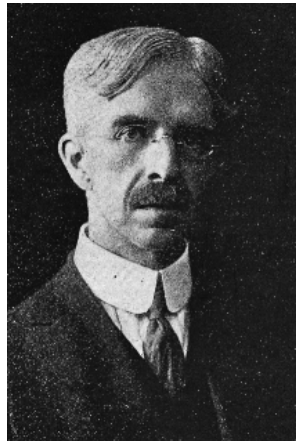
# Who Invented Activated Sludge?



William Lockett



Edward Ardern



Stephen DeM. Gage  
&  
Harry Clark



Ernest Moore Mumford



Gilbert Fowler



The world-wide interest taken in  
**The Activated Sludge System  
of Sewage Purification**

and the results already obtained at Manchester, Milwaukee, Worcester, Stamford and elsewhere demonstrate its advantages over every other known system.

It reduces the Area of Works.

Aerial Nuisance,  
Time of Treatment,  
Capital Outlay,  
Annual Cost.

It eliminates Chemicals,

Filters.  
Fly Nuisance.

It produces Any degree of Purification,  
A valuable Fertilizer.

---

The whole Sewage and Sludge problem solved at one operation, producing a sparkling liquid and a valuable fertilizer, justifies the anticipation that the time is not far distant when sewage works will become an important source of revenue instead of a heavy charge on the rates.

It also opens up great possibilities for the Consulting Engineer and the Biological Chemist.

---

FOR FURTHER PARTICULARS APPLY TO:

**JONES & ATTWOOD, Ltd.,**

PATENTEES AND  
MANUFACTURERS,

**Stourbridge.**

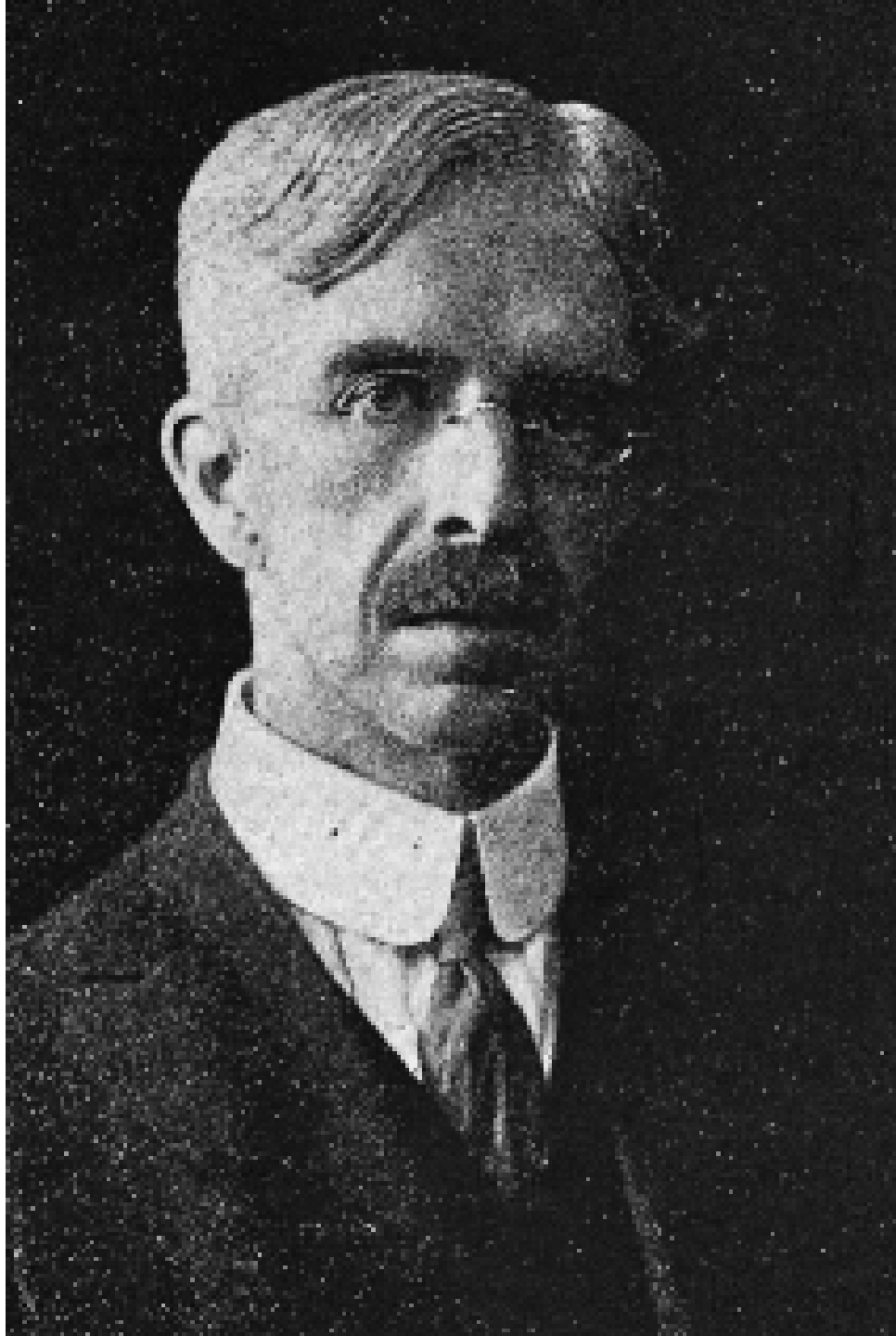
Telegrams:  
"HEAT, STOURBRIDGE."

Telephone:  
No. 10, STOURBRIDGE.

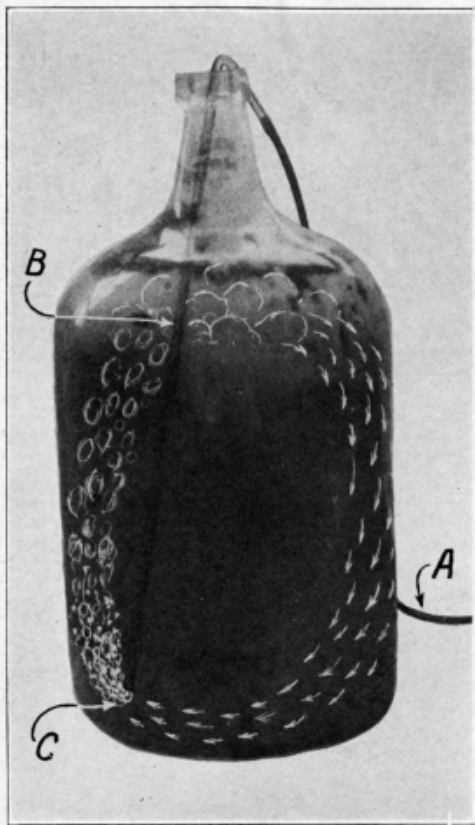




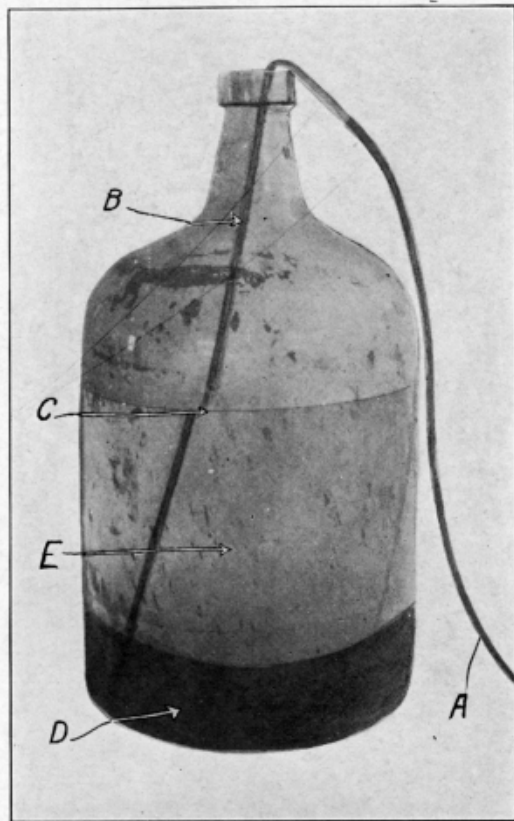
W. Vickers. H. N. Jackson.  
 J. H. Pollard. H. Lunt. A. L. Johnson. H. Davis. S. H. Hamford. A. D. P. Fullman.  
 W. Stafford. J. H. Brewster. J. H. Brookhilt. T. Wright. C. H. King. A. L. Hammond. J. H. Litcher. J. P. Bainbridge. H. Stephen. J. G. Dyer. Mr. Andrews.  
 Dr. A. L. Smith. Prof. Carpenter. H. Edge. D. H. Appleby. D. Barnwell. J. P. Cuyler. A. Spore. F. D. Mills. W. H. Kelly. J. H. Crabtree. Mr. R. H. Edwards. A. C. Sibley.  
 Dr. Johnson. Mr. Lambden. Dr. Cook. Mrs. C. Clift. Dr. Wiggmann. Prof. Parker. Prof. H. A. Dixon. Dr. H. Smith. Dr. Holt. Dr. Lyman.  
 A. Pollard. J. H. Mayson.



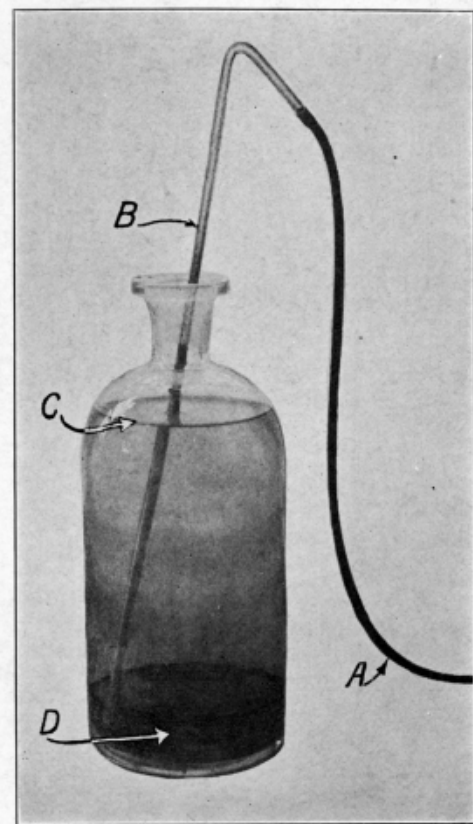
Stephen DeM. Gage



DEFT'S. EX. 7  
APRIL, 1912

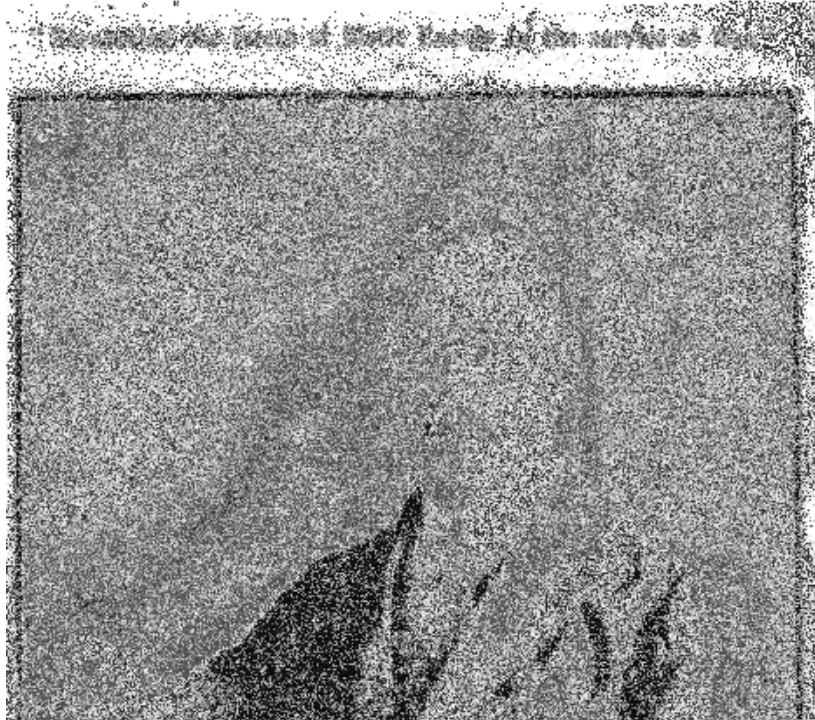


DEFT'S. EX. 6  
APRIL, 1912



DEFT'S. EX. 8  
APRIL, 1912





Gilbert Fowler



Edward Ardern

ammonio silver nitrate in a similar manner to the others gave on analysis:—silver, 36.18 and 36.35; nitrogen, 25.65 and 25.63 per cent. Calculated for

$(C(NO_2)_2NHAg)3NH_3$ , Ag 35.9, N, 25.7 per cent.

Molecular weight determination (boiling point) in acetone gave results distinctly confirmatory of the above formula, but ammonia seems to be split off from these compounds by long heating in acetone or alcohol. All these substances explode or burn rapidly when heated and are also sensitive when dry to percussion or friction.

Beyond the analyses and ebullioscopic molecular weight determination, no proof of the above formula is at present put forward.

## Manchester Section.

Meeting held at the Grand Hotel on Friday, April 3rd, 1914.

MR. J. H. ROSEASON IN THE CHAIR.

### EXPERIMENTS ON THE OXIDATION OF SEWAGE WITHOUT THE AID OF FILTERS.

BY EDWARD ARDERN, M.Sc., AND WILLIAM T. LOCKETT, M.Sc.

It has long been known that if sewage be exposed to the air for a sufficient period of time, the organic contents are gradually oxidised, with the formation of a deposit of so-called "humus" and the final production of nitrate from the ammonium salts and the nitrogenous organic matter.

This purification change of which the course of the reaction has been so carefully studied and thoroughly worked out by Adeney in his researches on behalf of the Royal Commission on Sewage Disposal, takes place, however, comparatively slowly, and even if aided by direct aeration, by no means becomes a practical method of sewage purification.

ated that aeration *per se* could not be considered as a practicable adjunct in the process of sewage purification.

Recently, however, the subject has been reopened by the work of Black and Phelps, Clark, Gage and Adams, and Fowler and Mumford.

In dealing with the question of the pollution of the New York Harbour, Black and Phelps<sup>7</sup> studied the possibilities of the application of aeration to the treatment of sewage.

Their experiments dealt with the aeration of both fresh and partially septicised sewage, in various types of tanks and it was shown that under certain conditions it was possible by means of a reasonable amount of aeration to remove the more readily putrescible matters from the sewage and thereby to a certain extent increase its stability.

Black and Phelps were so far convinced of the practicability of such methods of treatment of sewage, as to recommend that the sewage from a certain section of the New York area should be dealt with on these lines, prior to discharge into the waters of the harbour.

In the Annual Report of the Massachusetts State Board of Health for the year 1912, published at the end of 1913, is described an investigation by Clark and De M. Gage on the possibilities of the use of aeration for preliminary treatment of sewage prior to filtration. They found that simple aeration of sewage for 24 hours reduced the free and albuminoid ammonia to some extent and that with sewage which was both aerated and seeded with green growths—*Protococcus* and *Scenedesmus*—the albuminoid ammonia was even more noticeably reduced. Later it was found that appreciable nitrification was obtained within 24 hours in the aerated sewage containing the green growths.

Subsequently Clark and Gage found that aeration for a much shorter period, in a tank containing slabs of slate about one inch apart, covered with a compact brown growth of sewage matters, was sufficient to coagulate the sewage colloids, and thus to produce a well clarified non-nitrified effluent capable of satisfactory filtration at several times the normal rate.

Later Fowler and Mumford<sup>8</sup> carried out experiments



Edward Bartow and Gilbert Fowler







W. JONES.

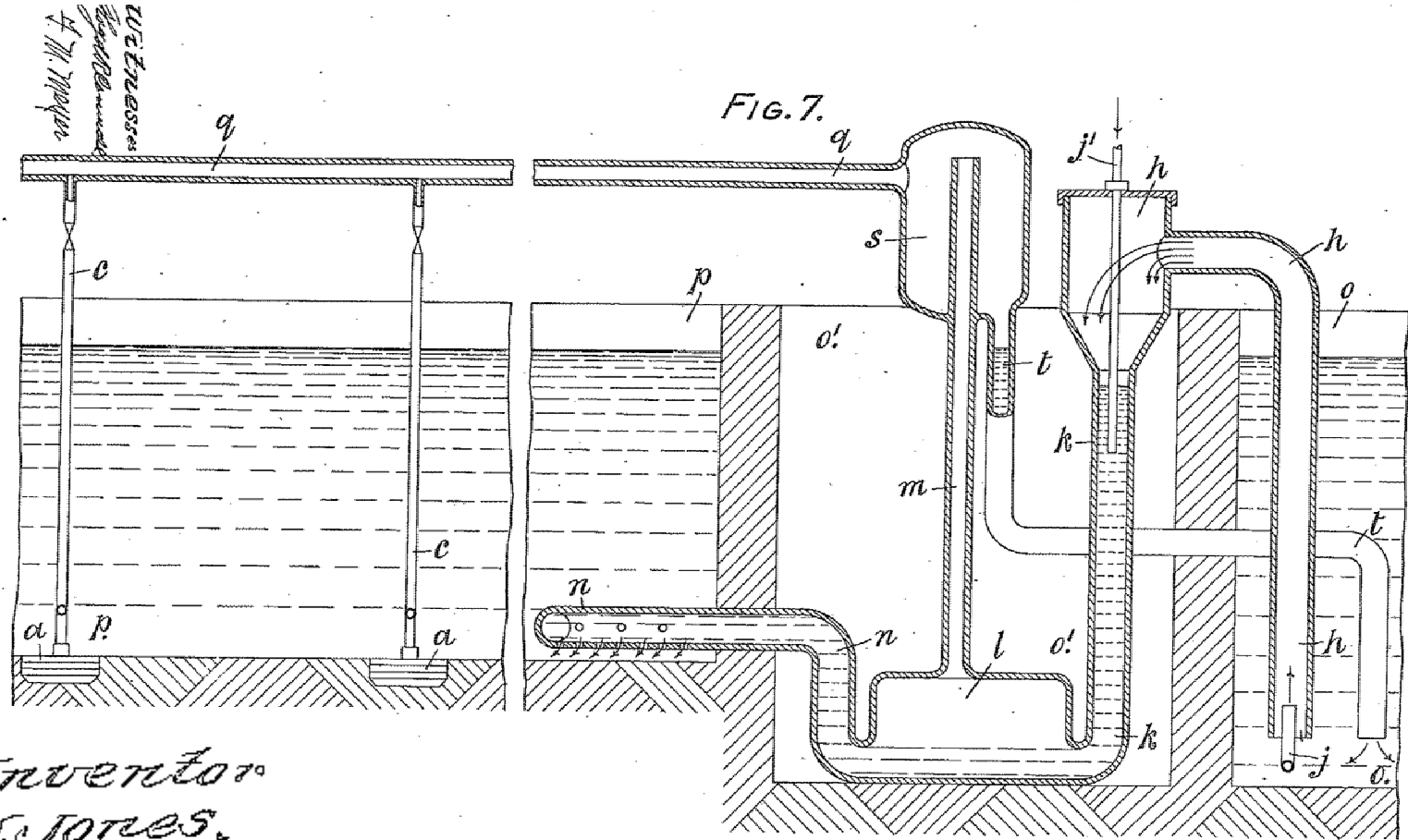
PURIFICATION OF SEWAGE AND ANALOGOUS LIQUIDS.

APPLICATION FILED OCT. 9, 1914.

1,247,540.

Patented Nov. 20, 1917.

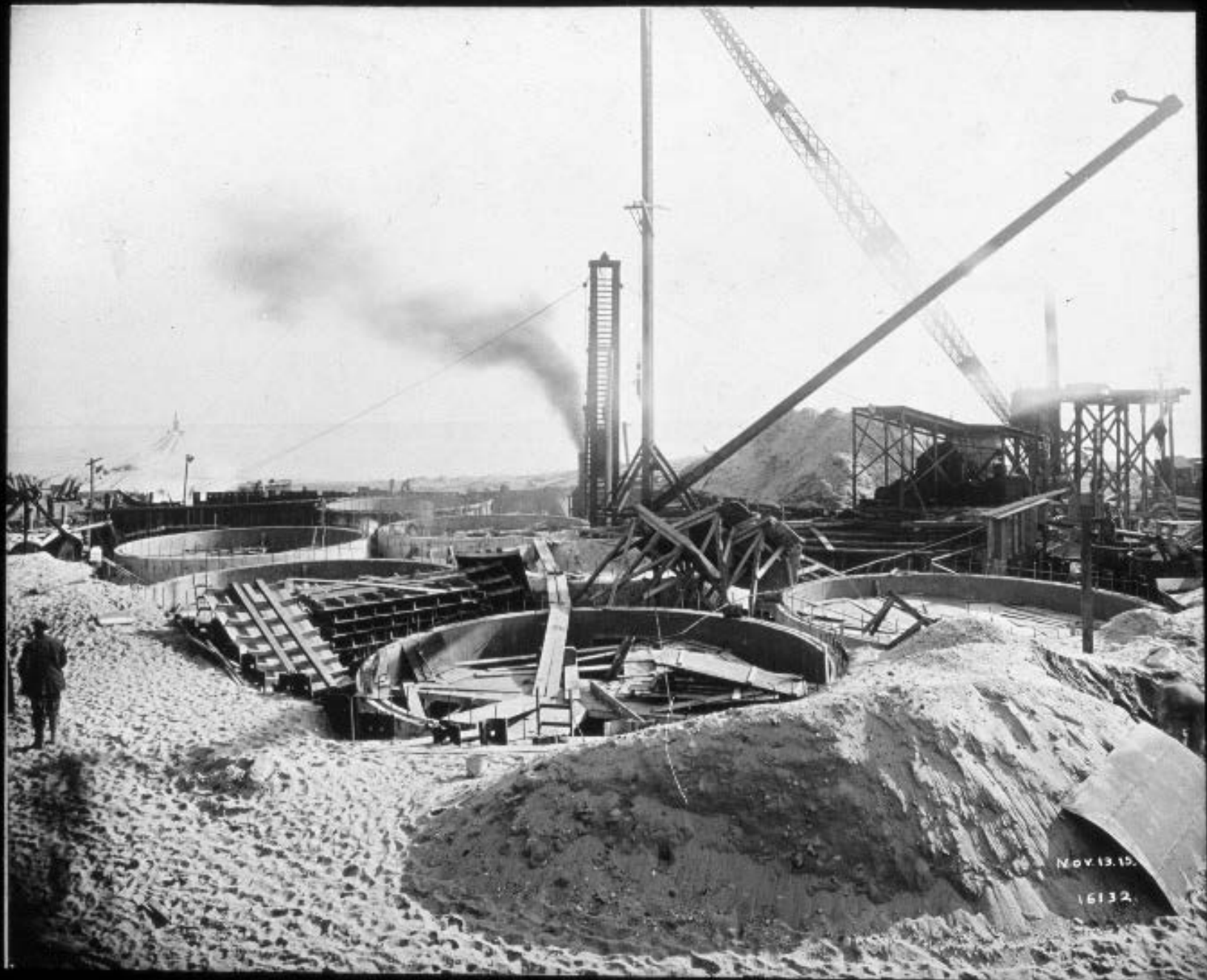
6 SHEETS—SHEET 3.



Inventor  
W. JONES.

By Geo. I. Davis

ATTY.



DIAGRAMATIC PLAN  
 OF  
 ACTIVATED SLUDGE SEWAGE  
 DISPOSAL PLANT  
 THE SEWERAGE COMMISSION  
 OF THE  
 CITY OF MILWAUKEE.  
 LOCATION - JONES ISLAND  
 SCALE  
 1" = 100'-0"

LEGEND

- Raw Sewage
- Sludge
- ↔ Mixed Liquor
- Effluent
- Air Main



All Area of Sewerage Commission Property. All Areas  
 Noted by Dotted & Conduits in Area.

BACTERIAL SEWAGE PURIFICATION  
ADAMS' PATENT SYPHON FEEDS



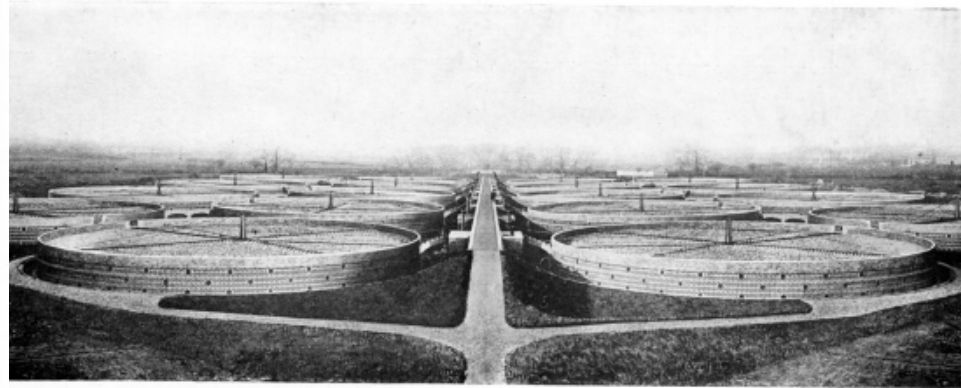
LEICESTER SEWAGE PURIFICATION WORKS, 12 ACRES IN EXTENT—E. G. MAWBAY, Esq., M.I.C.E.,  
CITY ENGINEER

BACTERIAL SEWAGE PURIFICATION  
ADAMS' PATENT SYPHONIC AUTOMATIC STORM-WATER DIVERTER

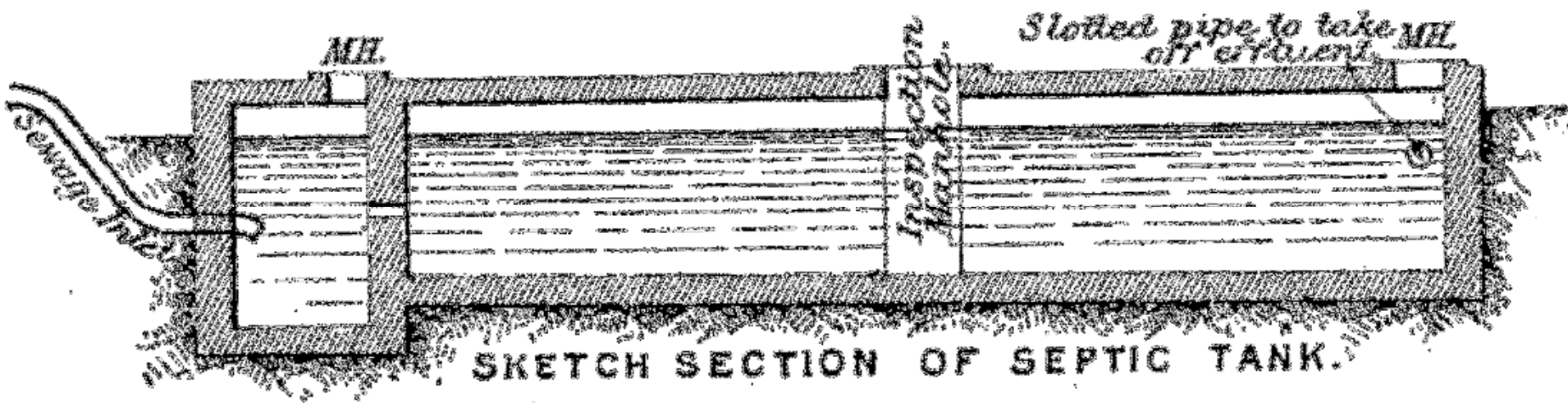


SURBITON SEWAGE PURIFICATION WORKS

BACTERIAL SEWAGE PURIFICATION  
ADAMS' PATENT "CRESSET" REVOLVING DISTRIBUTORS

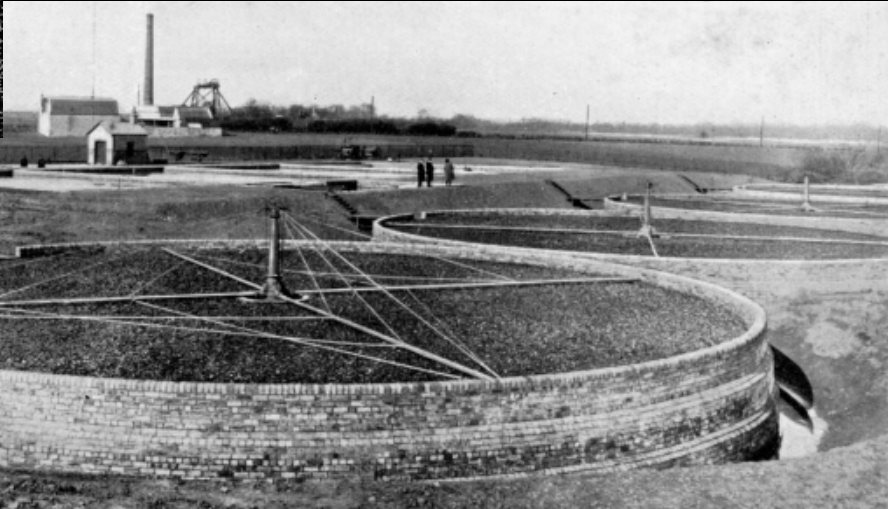
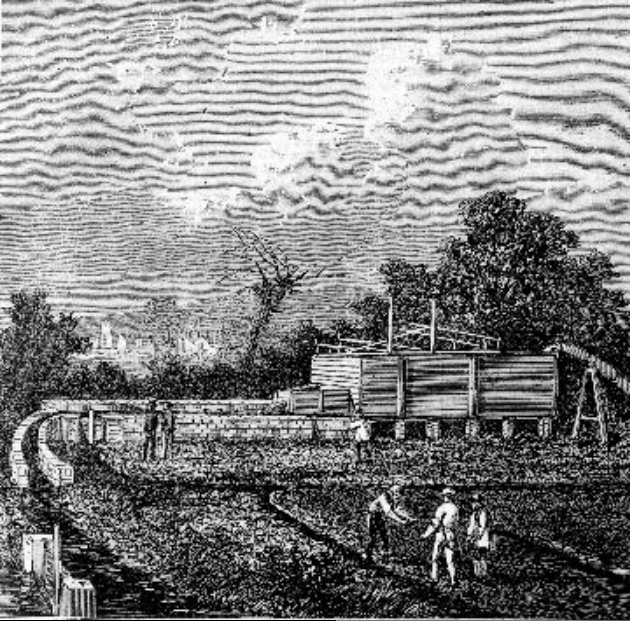


THIRTY 100-FT. DIAMETER "CRESSET" DISTRIBUTORS AT THE DERBY CITY SEWAGE WORKS  
MESSRS. J. MANSERGH & SON, CONSULTING ENGINEERS, WESTMINSTER, S.W.



SKETCH SECTION OF SEPTIC TANK.





*and Operating Gallery. 10/15/25*





W. JONES.

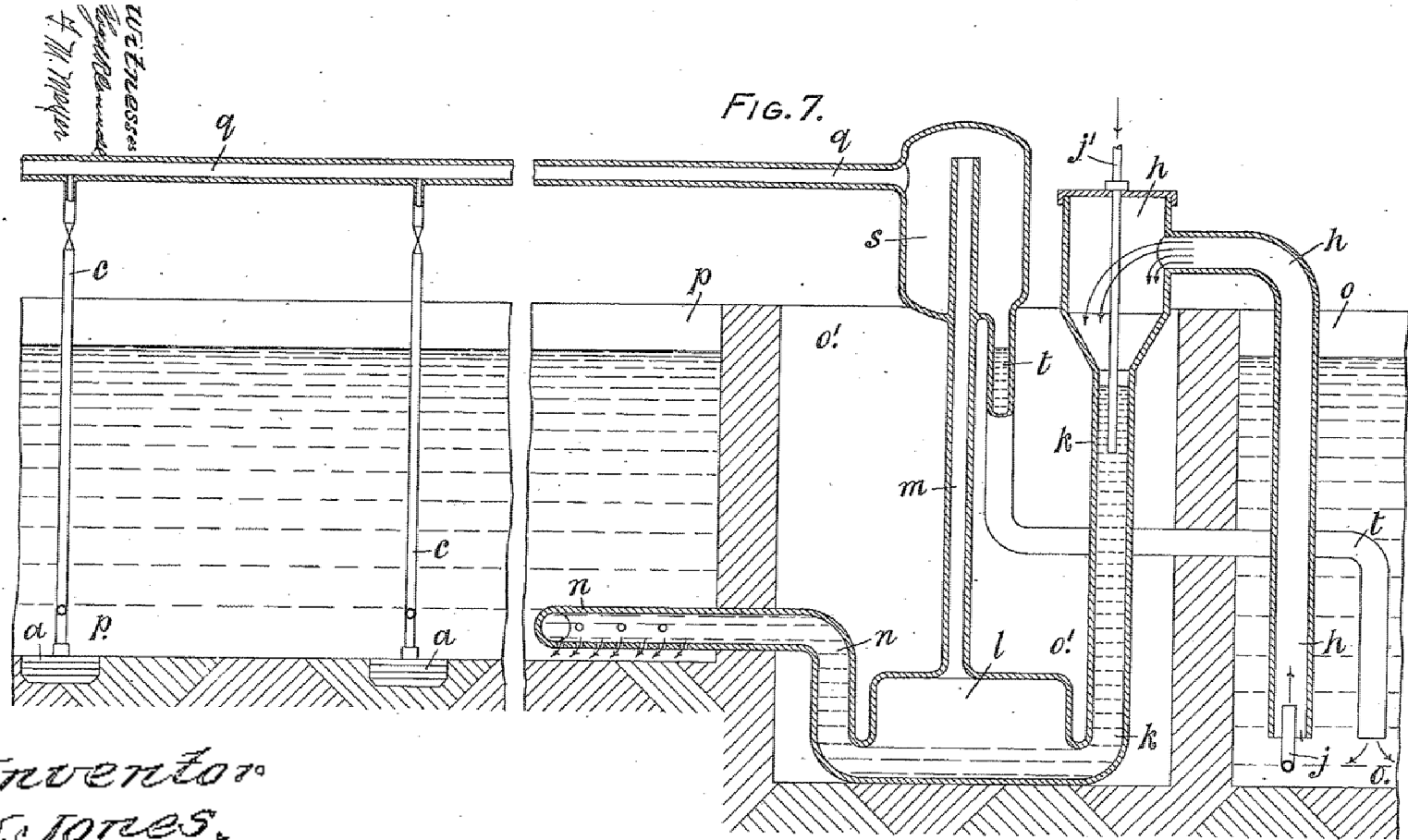
PURIFICATION OF SEWAGE AND ANALOGOUS LIQUIDS.

APPLICATION FILED OCT. 9, 1914.

1,247,540.

Patented Nov. 20, 1917.

6 SHEETS—SHEET 3.



Inventor  
W. JONES.

By Geo. I. Davis

ATTY.