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4/9/79

THE GENERAL ASBESTOS AND RUBBER DIVISION

of

RAYBESTOS MANHATTAN, INC.

North Charleston, S.C.

1934

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The dust survey included in this report is supplementary to the survey made in January, 1930 and was conducted to determine the extent of dust removal accomplished by the installation of new exhaust equipment and redesign of old exhaust equipment.

The number of buildings, the processes and arrangement of machinery are the same as at the time of the previous survey.

The exhaust systems of the cards have been redesigned to cover the machines more completely. In an experimental case one card was covered as completely as possible. This machine was enclosed in muslin and an air sample was taken inside the enclosure and two general air samples were taken in the card room proper at the same time. The first set of samples was taken before the conveyors from the preparation room began to bring the fibre to the bins in the card room. A second set of air samples was taken after the conveyors had been carrying fibre to the bins for more than an hour.

An exhaust system and revolving brush are in use for the inspection of woven cloth in the weave room. This work was formerly done by hand brushing. The loose fibre is brushed from the cloth in order that any flaws could be noticed and removed.

Exhibit H.

An air sample was taken at the table and two general air samples were taken in the weave room at the same time - one set was taken with both the revolving brush and exhaust fan running and one set with the revolving brush operating but without the exhaust fan. One set was taken with the workmen brushing the cloth by hand, the method used before the exhaust system and revolving brush were installed.

The inspection table was enclosed with beaver board and a series of samples was taken both inside the enclosure and outside.

The following tables indicate the analysis of air samples taken at representative points in the different departments. Attention is called to the fact that the previous survey was made in January and this survey in July.

Particle size measurements were made of the dust by a direct projection method. The results are tabulated and appear in the graphs attached at the rear of the report. It will be noted that from 92 to 98.5% of the particles are less than 10 microns in greatest diameter.

A detailed discussion of the disease asbestosis and a correlation of the X-ray findings are reserved for the general report.

# PREPARATION ROOM

| Sample No. | Station                                                               | Date    | Cu. Ft.<br>Air Sampled | Millions of<br>Particles per cu.<br>ft. air sampled | Millions of<br>Particles less<br>than 10 microns per<br>cu. ft. air sampled | Type<br>of<br>Dust        | Remarks                                                                                       |
|------------|-----------------------------------------------------------------------|---------|------------------------|-----------------------------------------------------|-----------------------------------------------------------------------------|---------------------------|-----------------------------------------------------------------------------------------------|
| 1          | At chaser #1 near open<br>doors                                       | 7/9/34  | 32.6                   | 1.9                                                 | 1.8                                                                         | Asbestos                  | One man working<br>at two chasers<br>African C & G                                            |
| 2          | At chaser #4                                                          | "       | 26.7                   | 8.2                                                 | 7.9                                                                         | "                         | Man uses hands<br>to put asbestos<br>from bag into<br>chaser and from<br>chaser into<br>truck |
| 3          | At end of fibre shaker<br>screen                                      | "       | 48.9                   | 2.6                                                 | 2.5                                                                         | "                         | Separating lon.<br>fibre from sho<br>fibre                                                    |
| 4          | At feeding end of Garnet<br>machine                                   | "       | 34.2                   | 1.2                                                 | 1.1                                                                         | "                         | Waste yarn put<br>onto conveyor<br>by one man                                                 |
| 5          | At fly shaker                                                         | 7/10/34 | 29.1                   | 1.5                                                 | 1.4                                                                         | "                         | One man                                                                                       |
| 6          | At vertical fibre opener                                              | "       | 27.2                   | 0.87                                                | 0.83                                                                        | "                         | Kopper end, on<br>man                                                                         |
| 7          | Floor mixing of cotton<br>and asbestos                                | "       | 39.5                   | 7.8                                                 | 7.6                                                                         | Asbestos<br>and<br>cotton | Two men mixing<br>one forking<br>mixture into<br>picker #2                                    |
| 8          | At shaker screen, loading<br>hand trucks with asbestos<br>from opener | "       | 31.3                   | 8.1                                                 | 7.7                                                                         | Asbestos                  | One man; asbe.<br>tes drops off<br>end of shaker<br>screen into<br>truck.                     |
| 9          | At feeder end of cotton<br>fibre opener                               | "       | 30.1                   | 1.3                                                 | 1.3                                                                         | Cotton                    | One man                                                                                       |
| 10         | At conveyor end of<br>picker #2                                       | "       | 25.9                   | <u>1.9</u>                                          | 1.8                                                                         | Cotton<br>and<br>asbestos | Material drop<br>from one belt<br>to another,<br>oil mixed in                                 |

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• The average dust count of the Preparation Room is 3.5 million particles, which is identical with the  
average found in January, 1930.

| CARD ROOM  |                                                                                     |         |                     |                                               |                                                                    |              |                                                              |
|------------|-------------------------------------------------------------------------------------|---------|---------------------|-----------------------------------------------|--------------------------------------------------------------------|--------------|--------------------------------------------------------------|
| Sample No. | Station                                                                             | Date    | Cu. Ft. Air Sampled | Millions of Particles per cu. ft. air sampled | Millions of Particles less than 10 microns per cu. ft. air sampled | Type of Dust | Remarks                                                      |
| 27         | Card room - center aisle between cards #2 and 21                                    | 7/11/34 | 30.7                | 5.5                                           | 5.2                                                                | Asbestos     | No humidifiers                                               |
| 28         | General air - card room center aisle, west of bins                                  | "       | 48.4                | 15.9                                          | 15.2                                                               | "            | Between cards #10 and #29; belt broken on fan                |
| 29         | General air - card room, center aisle, east of bins                                 | "       | 28.8                | 13.2                                          | 12.6                                                               | "            | Between cards #35 and #16; belt broken on fan                |
| 30         | General air - wick, rope and twisted card room                                      | "       | 31.6                | 2.7                                           | 2.6                                                                | "            |                                                              |
| 37         | General air - west of bins - card room; conveyors from preparation room not running | 7/12/34 | 35.7                | 1.8                                           | 1.7                                                                | "            | Same time as #38 and #39.                                    |
| 38         | Inside mail enclosure, " one card                                                   | "       | 28.2                | 1.5                                           | 1.4                                                                | "            | • Card #32 Windows closed; same time as #37 and #39, one man |
| 39         | General air - east of bins - card room                                              | "       | 32.6                | 2.8                                           | 2.7                                                                | "            | • Same time as #37 and #38                                   |
| 40         | General air - west of bins, card room; conveyors from preparation room running      | "       | 30.6                | 4.5                                           | 4.3                                                                | "            | • Same time as #41 and #42                                   |
| 41         | Inside enclosure - conveyors from preparation room running                          | "       | 28.2                | 5.0                                           | 4.6                                                                | "            | • One man, same time as #40 and #42                          |
| 42         | General air - east of bins, card room                                               | "       | 30.4                | 4.1                                           | 3.9                                                                | "            | • Same time as #40 and #41                                   |

General air samples - average 3.5 on samples 27, 30, 37, 39, 40 and 42. The average for the survey of January 1930 was 2.6 million particles per cubic foot.

\* Not included in averaging

SPINNING DEPARTMENT

| Sample No. | Station                           | Date    | Cu. Ft.<br>Air Sampled | Millions of<br>Particles per<br>cu. ft. air<br>sampled | Millions of<br>Particles less<br>than 10 microns per<br>cu. ft. air sampled | Type<br>of<br>Dust    | Remarks                                                              |
|------------|-----------------------------------|---------|------------------------|--------------------------------------------------------|-----------------------------------------------------------------------------|-----------------------|----------------------------------------------------------------------|
| 13         | Bldg. #5, general air, braidere   | 7/10/34 | 29.4                   | 1.1                                                    | 1.0                                                                         | Asbestos and graphite | Two men making stock for ring presses; graphite and fish oil         |
| 14         | General air, ring frame spinning  | "       | 32.3                   | 0.99                                                   | 0.94                                                                        | Asbestos              | Two women - 4 men                                                    |
| 15         | General air - twistere            | "       | 30.0                   | 2.3                                                    | 2.2                                                                         | "                     | Twisting yarn and brass                                              |
| 16         | General air - spoolere            | "       | 27.9                   | 0.93                                                   | 0.89                                                                        | "                     | Four women, spooling yarn from ring frame near windows on north side |
| 17         | General air - spoolere            | "       | 30.4                   | 8.1                                                    | 7.7                                                                         | "                     | Ten women, spooling yarn from mule spinnere at partition wall        |
| 18         | General air - mule spinning       | "       | 30.3                   | 2.5                                                    | 2.4                                                                         | "                     | In aisle between #3 and #4 - #9 and #10 - mules                      |
| 19         | General air - mule spinning       | "       | 30.4                   | 1.3                                                    | 1.3                                                                         | "                     | In aisle between #9 and #10 - #15 and #16 - mules                    |
| 11         | General air Bldg. #5 braidere     | "       | 33.5                   | 1.6                                                    | 1.6                                                                         | "                     | Two women - two men                                                  |
| 12         | Bldg. #5 between two ring presses | "       | 23.4                   | 2.1                                                    | 2.0                                                                         | Asbestos and graphite | Two men forming small-sized packing                                  |

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Average general air samples #14 to 19 inclusive, spinning - 2.68 million particles per cubic foot air, which is higher than average of .6 million found in survey of January 1930. This is accounted for by fact that at time of previous survey more mule spinning and less frame spinning was done, i.e., ring frame spinning and twisting may be greater dust producers than mule spinning. The possibility of dust from the collectors on top of the machine shop and adjacent to this department being blown into the mule spinning should not be overlooked.

LEAVE ROOM

| Sample No. | Station                                                                                      | Date    | Cu. Ft.<br>Air Sampled | Millions of<br>Particles per cu.<br>ft. air sampled | Millions of<br>Particles less<br>than 10 microns<br>per cu. ft. air<br>sampled | Type<br>of<br>Dust | Remarks                                                                               |
|------------|----------------------------------------------------------------------------------------------|---------|------------------------|-----------------------------------------------------|--------------------------------------------------------------------------------|--------------------|---------------------------------------------------------------------------------------|
| 22         | General air - west<br>end of weave room                                                      | 7/10/34 | 32.6                   | 6.3                                                 | 6.1                                                                            | Asbestos           |                                                                                       |
| 24         | Same as #22                                                                                  | 7/11/34 | 35.7                   | 0.6                                                 | 0.5                                                                            | "                  |                                                                                       |
| 25         | At inspection table<br>woven cloth                                                           | "       | 27.3                   | 2.6                                                 | 2.5                                                                            | "                  | Revolving brush -<br>exhaust hood - two<br>men                                        |
| 26         | General air - east<br>end of weave room                                                      | "       | 27.9                   | 5.5                                                 | 5.3                                                                            | "                  |                                                                                       |
| 31         | Inspection table en-<br>closed in beaver board<br>two men - sample taken<br>inside enclosure | "       | 20.2                   | 3.2                                                 | 3.0                                                                            | "                  | Taken with revolving<br>brush and exhaust<br>running, Manhattan<br>cloth G315 and 160 |
| 32         | Taken just outside<br>enclosure                                                              | "       | 19.0                   | 9.4                                                 | 9.3                                                                            | "                  | Same time as #31                                                                      |
| 33         | Taken inside<br>enclosure                                                                    | "       | 20.2                   | 23.2                                                | 21.9                                                                           | "                  | Revolving brush -<br>no exhaust two men                                               |
| 34         | Taken outside<br>enclosure                                                                   | "       | 18.8                   | 1.5                                                 | 1.5                                                                            | "                  | Same time as #33                                                                      |
| 35         | Taken inside<br>enclosure                                                                    | "       | 20.2                   | 1.5                                                 | 1.4                                                                            | "                  | Hand brushing -<br>three men                                                          |
| 36         | Taken outside<br>enclosure                                                                   | "       | 19.0                   | 2.1                                                 | 2.0                                                                            | "                  | Same time as #35                                                                      |
| 43         | General air - west end<br>of weave room                                                      | 7/13/34 | 18.8                   | 9.3                                                 | 9.2                                                                            | "                  | Before work started<br>in morning, shut<br>down from midnight                         |
| 44         | General air - east end<br>of weave room                                                      | "       | 18.6                   | 6.0                                                 | 5.9                                                                            | "                  | " " "                                                                                 |

The dust counts of samples #43 and 44 were taken before work started in the morning. These counts are considerably higher than samples taken during operating periods. This may be due to closing of windows, shutting off of humidifiers and floor sweeping.

# BEAVE ROOM (Continued)

| Sample No. | Station                                                           | Date    | Cu. Ft.<br>Air Sampled | Millions of<br>Particles per cu.<br>ft. air sampled | Millions of<br>Particles less<br>than 10 microns<br>per cu. ft. air<br>sampled | Type<br>of<br>Dust | Remarks                                                                |
|------------|-------------------------------------------------------------------|---------|------------------------|-----------------------------------------------------|--------------------------------------------------------------------------------|--------------------|------------------------------------------------------------------------|
| 45         | General air - east<br>end of weave room                           | 7/13/34 | 27.0                   | 2.6                                                 | 2.6                                                                            | Asbestos           | Same time as #46<br>and 47; weave room<br>started at 7<br>o'clock      |
| 46         | General air - west<br>end of weave room                           | "       | 27.9                   | 2.7                                                 | 2.7                                                                            | "                  | Same time as #45<br>and 47                                             |
| 47         | At inspection table<br>for woven cloth, dry<br>woven cloth 10P225 | "       | 30.3                   | 0.8                                                 | 0.8                                                                            | "                  | Revolving brush<br>and exhaust; two<br>men, same time as<br>#45 and 46 |
| 48         | Same location as #45                                              | "       | 27.0                   | 3.0                                                 | 2.9                                                                            | "                  | Same time as #49<br>and 50                                             |
| 49         | Same location as #46                                              | "       | 27.9                   | 3.1                                                 | 3.0                                                                            | "                  | Same time as<br>#48 and 50                                             |
| 50         | Inspection table -<br>hand brushing                               | "       | 30.3                   | 0.8                                                 | 0.8                                                                            | "                  | Three men - at<br>same time as #48<br>and 49                           |
| 51         | Same location as #45                                              | "       | 18.9                   | 4.9                                                 | 4.8                                                                            | "                  | At same time as<br>#52 and 53                                          |
| 52         | Same location as #46                                              | "       | 20.5                   | 0.9                                                 | 0.9                                                                            | "                  | Same time as<br>#51 and 53                                             |
| 53         | Table inspection<br>woven cloth, revolving<br>brush, no exhaust   | "       | 21.2                   | 1.8                                                 | 1.7                                                                            | "                  | Same time as<br>#51 and 52; two<br>men                                 |

General air samples, #22, 24 and 26, 45, 46, 48, 49, 51 and 52, averaged  
3.5 million particles per cubic foot air, as compared with .6 found in survey of January 1930.

# PACKING DEPARTMENT

| Sample No. | Station                                    | Date    | Cu. Ft.<br>Air Sampled | Millions of<br>Particles per cu.<br>ft. air sampled | Millions of<br>Particles less than<br>10 microns per cu.<br>ft. air sampled | Type<br>of<br>Dust              | Remarks |
|------------|--------------------------------------------|---------|------------------------|-----------------------------------------------------|-----------------------------------------------------------------------------|---------------------------------|---------|
| 20         | General air - molded<br>packing department | 7/10/34 | 62.3                   | 0.45                                                | 0.43                                                                        | Asbestos                        |         |
| 23         | General air - rubber<br>compounding room   | "       | 28.2                   | 1.4                                                 | 1.3                                                                         | Clay<br>lead<br>talc<br>sulphur |         |

# LEAD ANALYSES

| Sample No. | Station                                  | Date    | Cu. Ft.<br>Air Sampled | Milligrams of lead per cu. ft.<br>air sampled | Type of<br>dust                 | Remarks                                |
|------------|------------------------------------------|---------|------------------------|-----------------------------------------------|---------------------------------|----------------------------------------|
| 21         | Between two rubber<br>compounding mills  | 7/10/34 | 33.6                   | Negative for lead                             | Clay<br>lead<br>talc<br>sulphur | Exhaust hood<br>with cloth<br>curtains |
| 23         | General air - rubber<br>compounding room | "       | 28.2                   | Negative for lead                             | "                               | "                                      |

# **CLOTH INSPECTION (WEAVE ROOM)**

Table showing the results of special tests run at the cloth inspection table

|                                 | Millions of Dust Particles<br>per cu. ft. air sampled | Normal conditions<br>enclosure removed |
|---------------------------------|-------------------------------------------------------|----------------------------------------|
| Inside enclosure (doors closed) | 3.5                                                   | 3.8                                    |
|                                 | 3.2                                                   | 0.8                                    |
|                                 | 23.2                                                  | 1.8                                    |
|                                 | 1.5                                                   | 0.8                                    |

Average general air -  
weave room during tests

Cloth inspection table -  
exhaust and revolving  
brush

Cloth inspection table -  
no exhaust but with  
revolving brush

Cloth inspection table -  
hand brushing, no  
exhaust

It was noted that only slight changes had been made in the preparation room since the survey in 1930. The method of oiling and conveying the fibre remains the same. As noted, the average dust count remained constant.

Extensive changes and increased methods of dust entrapping and removal in the card room were noted. The method of conveying the fibre from the preparation to the card room is the same and the fibre is carted from the storage bins to the feed hoppers on the cards in the same manner.

Natural ventilation is supplied by open windows which occupy approximately two thirds of the total wall space.

Samples No. 37 and 39 were taken before the fibre conveyors from the preparation room were running, while samples No. 40 and 42 were taken after the conveyors were put into operation. The increased count is evidently due to dust generated by the fibre conveyors and leakage from the storage bins in the card room.

In the test on the enclosed card, samples 37, 38, and 39 were taken before the fibre conveyors were operating and samples No. 40, 41 and 42 were taken after the conveyors were running. The muslin enclosure is not effective in keeping out the fine dust, as evidenced by the comparison of counts on samples taken simultaneously inside and outside the enclosure. The increased counts after the conveyor was operating should be noted.

The natural ventilation in the weave room is augmented by a forced air supply through the fan and distributing ducts used for heating in the winter months. The chance of dust pollution from this outside air supply is remote, as the dust collectors are located at a distance east of the weave room. Experimental work is in progress on entrapping and exhausting dust generated by the looms.

Attention is called to the tests run on the cloth inspection table, with the mechanically operated brush, which show that the exhaust system is effective in keeping the dust concentration down to the same count as under the system of hand brushing without exhaust.

The lead pollution at the rubber compounding operations of the packing department has been corrected, as shown by the absence of lead in the air samples taken.

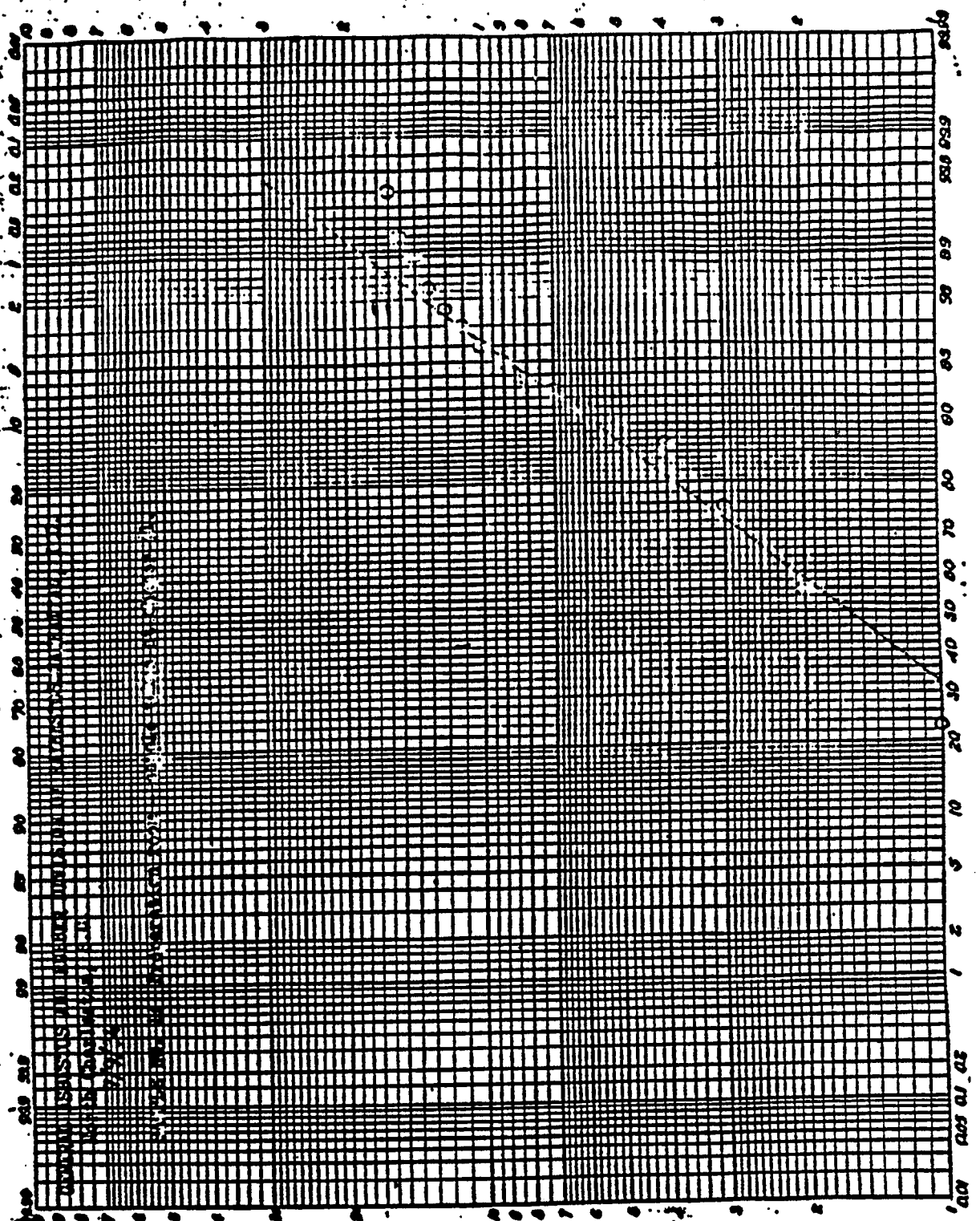
CONCLUSIONS AND RECOMMENDATIONS

An exhaust system is under construction in the card room and experimental work is in progress for entrapping and exhausting dust generated by the looms in the weave room, and until this work is completed and checks run on the efficiency of the exhaust system, no other recommendations can be made.

Tests conducted in the card room show that there is an increase in the general air dust content when the fibre conveyors are in operation. This is due to leakage of dust from the fibre storage bins in the card room and efforts should be made to seal this leakage.

ORDER BOOK COMPANY, INC. BOSTON, MASSACHUSETTS

NO. 5125. LOGARITHMIC PROBABILITY. DIMENSIONS BY INCHES, WHIPPLE & FULLER.



Dust particle sizes in microns

NO. 512. LOGARITHMIC PROBABILITY. DESIGNED BY HAZEN, WHIPPLE & FULLER.

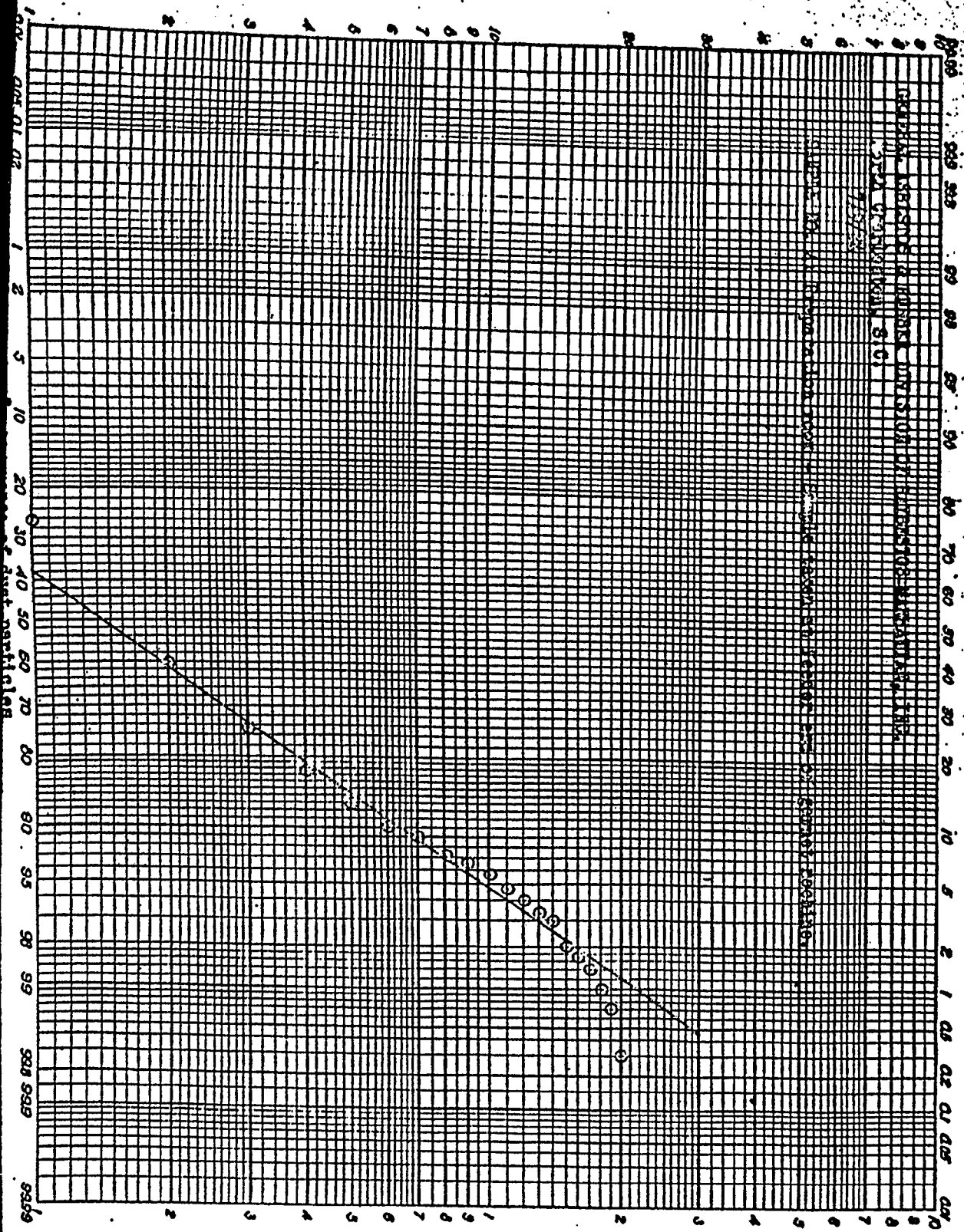
COOPER BOOK COMPANY, INC. NEWYORK, MASSACHUSETTS

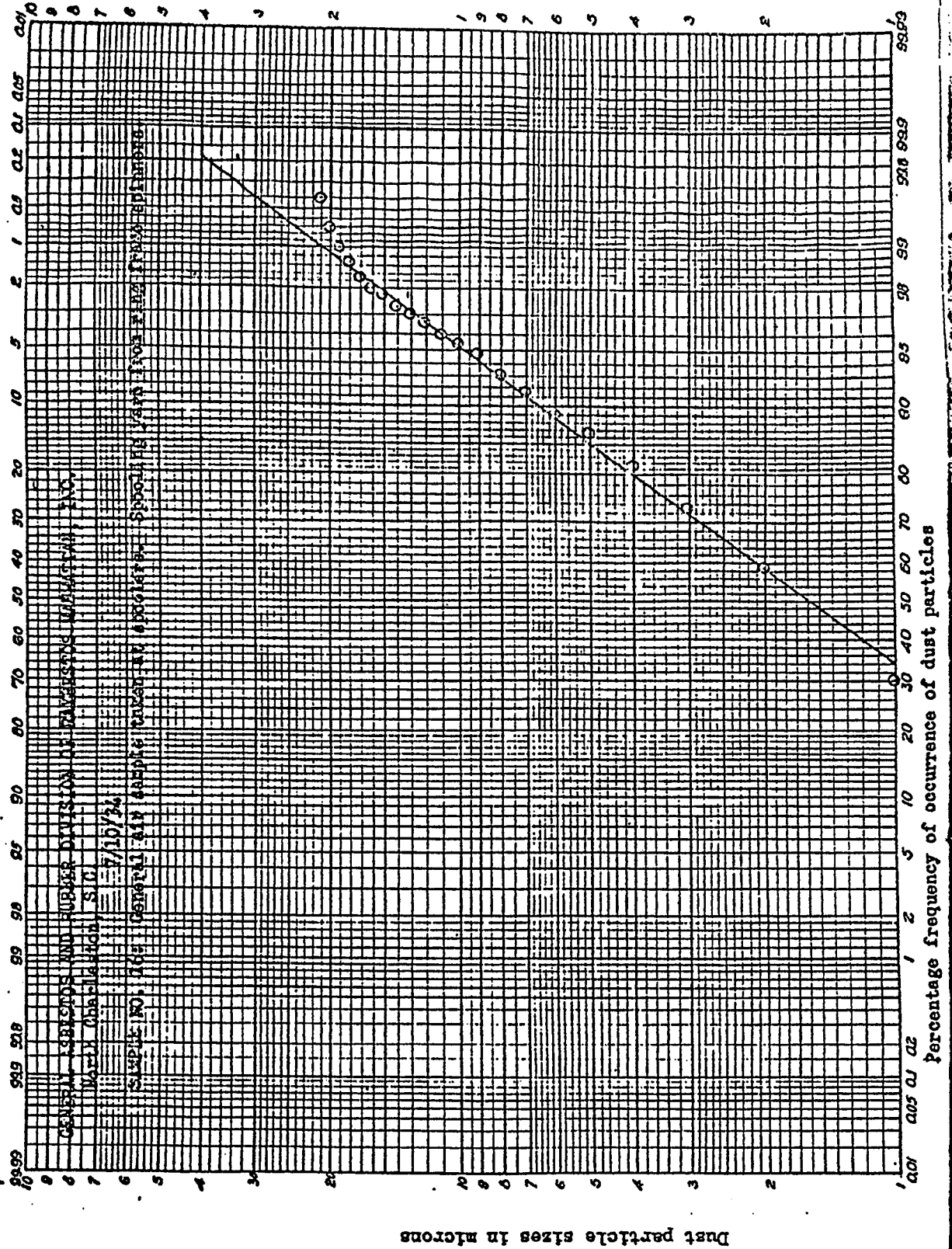


RECORD OF LOGARITHMIC PROBABILITY OF FLOODS FOR THE YEAR 1900  
 1900 1901 1902 1903 1904 1905 1906 1907 1908 1909 1910 1911 1912 1913 1914 1915 1916 1917 1918 1919 1920 1921 1922 1923 1924 1925 1926 1927 1928 1929 1930 1931 1932 1933 1934 1935 1936 1937 1938 1939 1940 1941 1942 1943 1944 1945 1946 1947 1948 1949 1950 1951 1952 1953 1954 1955 1956 1957 1958 1959 1960 1961 1962 1963 1964 1965 1966 1967 1968 1969 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000

THESE ARE THE LOGARITHMIC PROBABILITY OF FLOODS FOR THE YEAR 1900  
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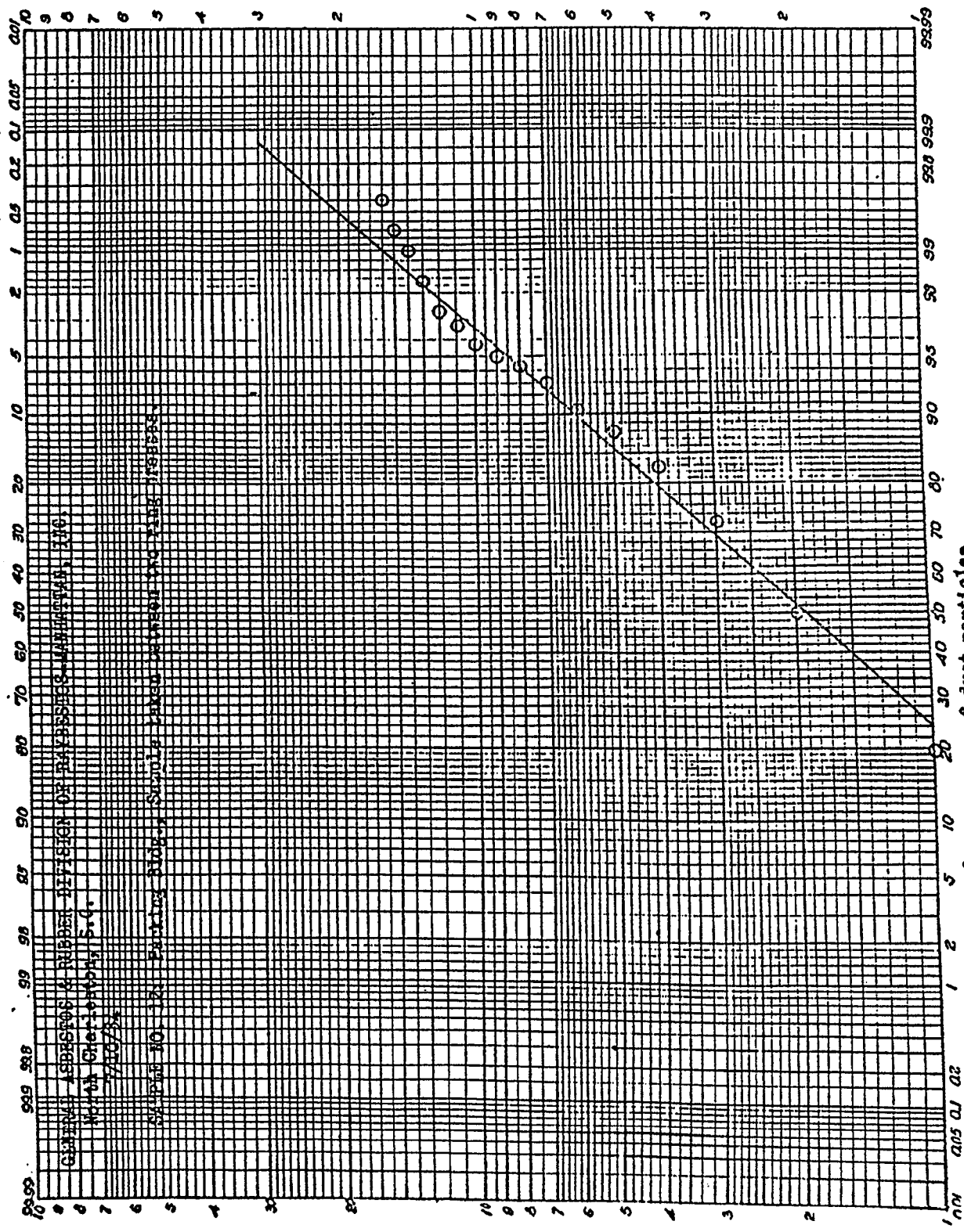
Dust particle sizes in microns



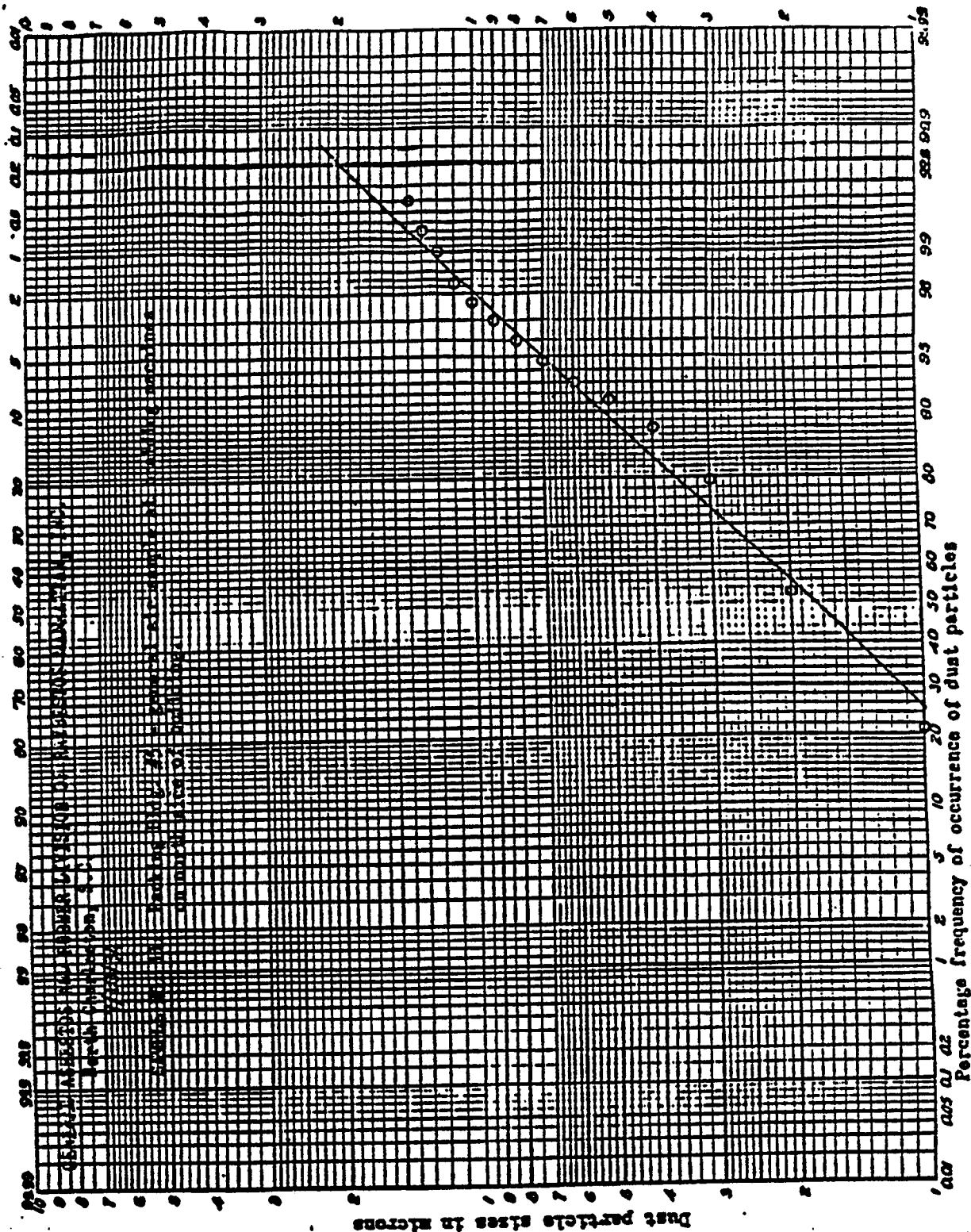


NO. 312B. LOGARITHMIC PROBABILITY. DESIGNED BY HAZEN, WHIFFLE & FULLER.

CODICE BOOK COMPANY, INC. NORWOOD, MASSACHUSETTS

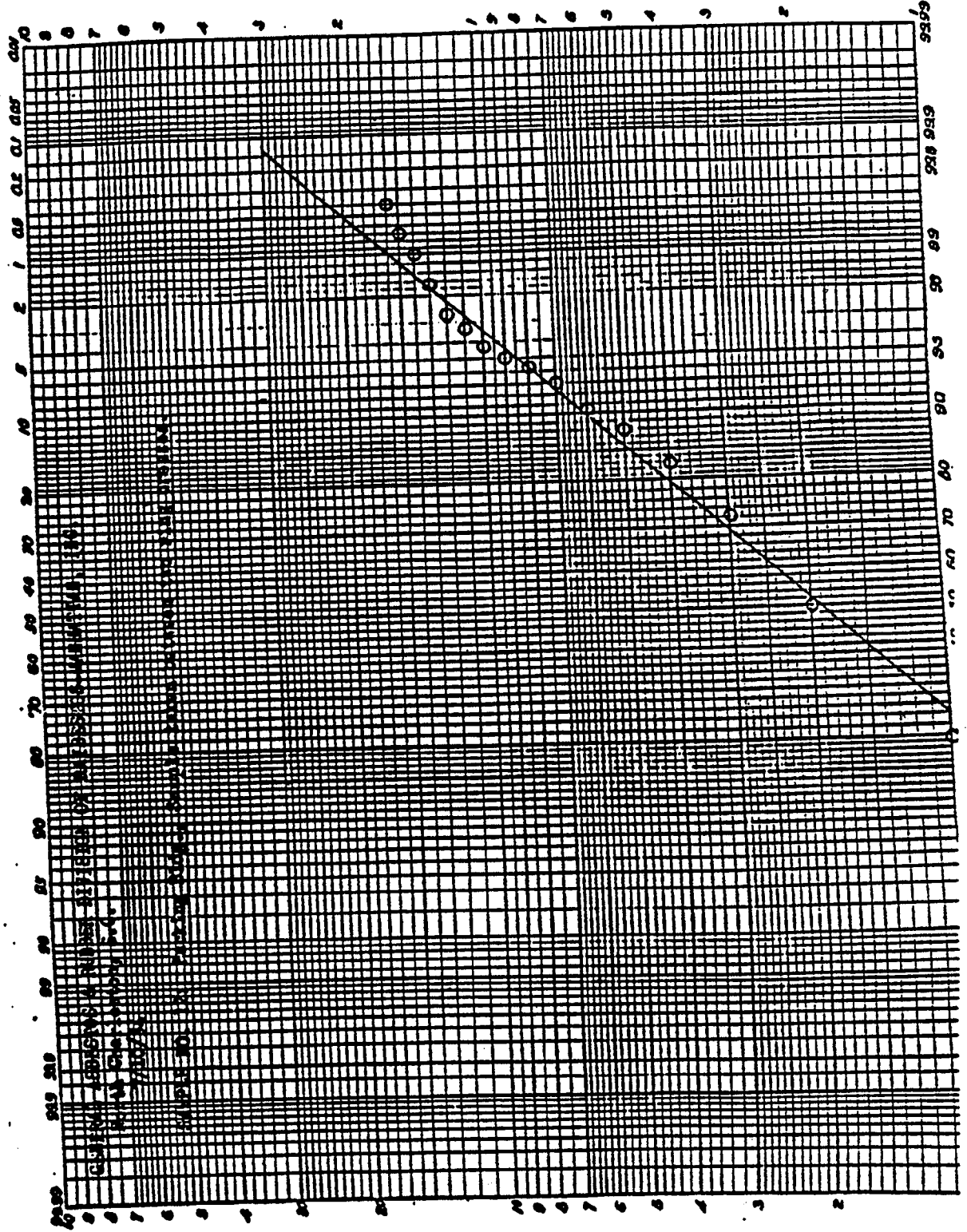


WATER RESISTANCE OF ADHESIVE PARTICLES



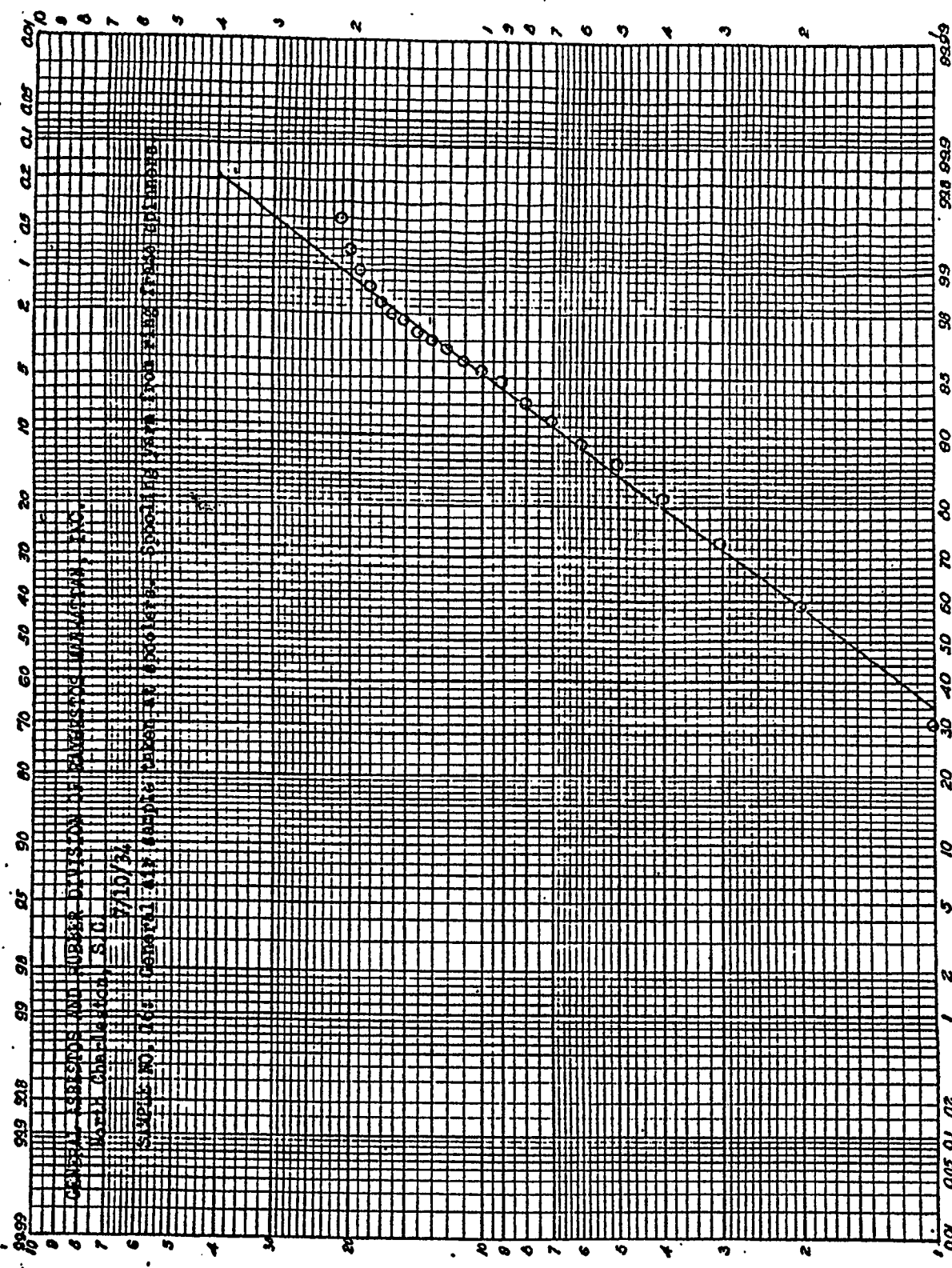
CODE BOOK COMPANY, INC. BOSTON, MASSACHUSETTS

NO. 512B. LOGARITHMIC PROBABILITY. DESIGNED BY MAJOR, BRIMLEY & FULLER.



Percentage frequency of occurrence of dust particles

Dust particle sizes in microns

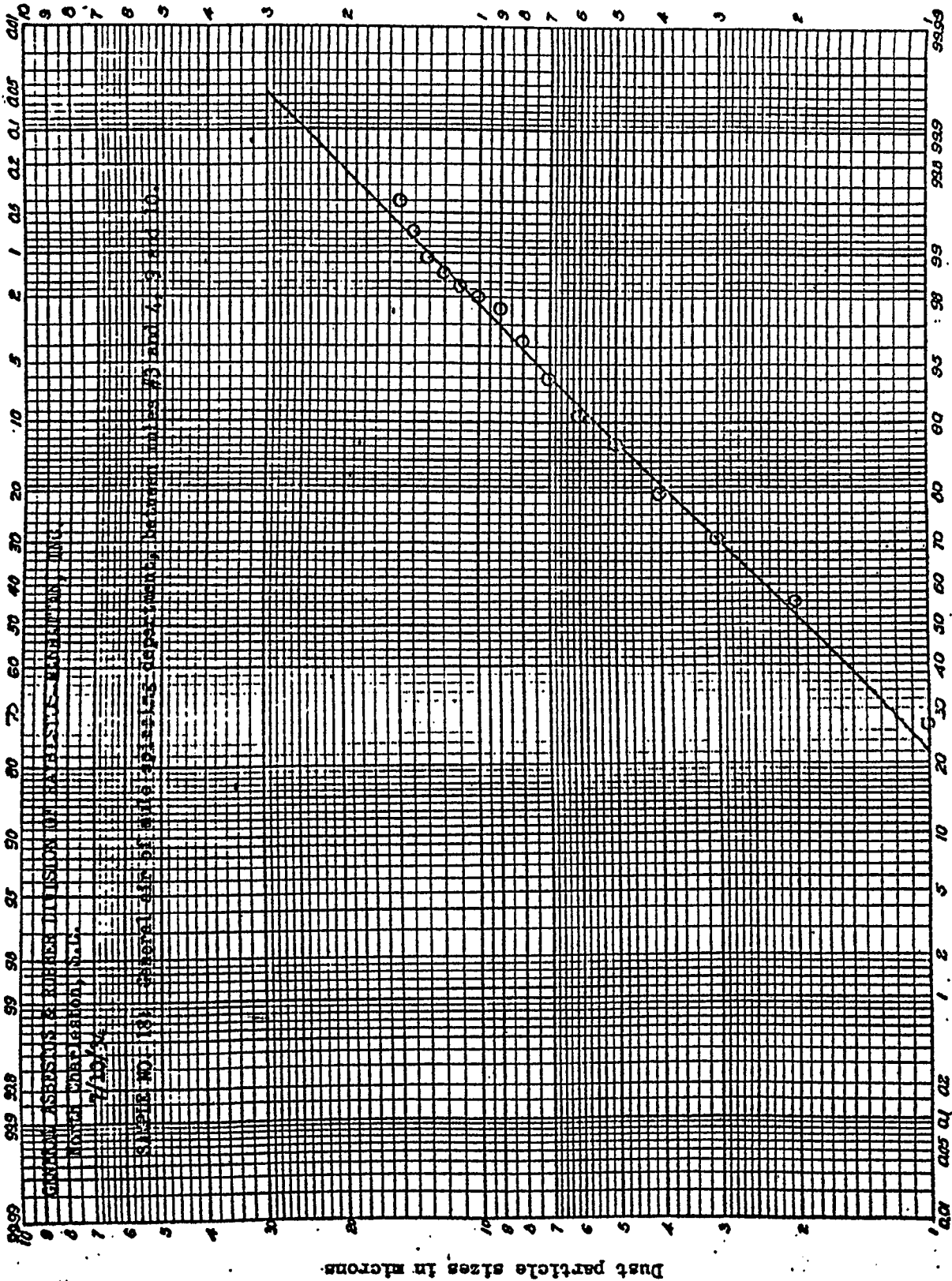


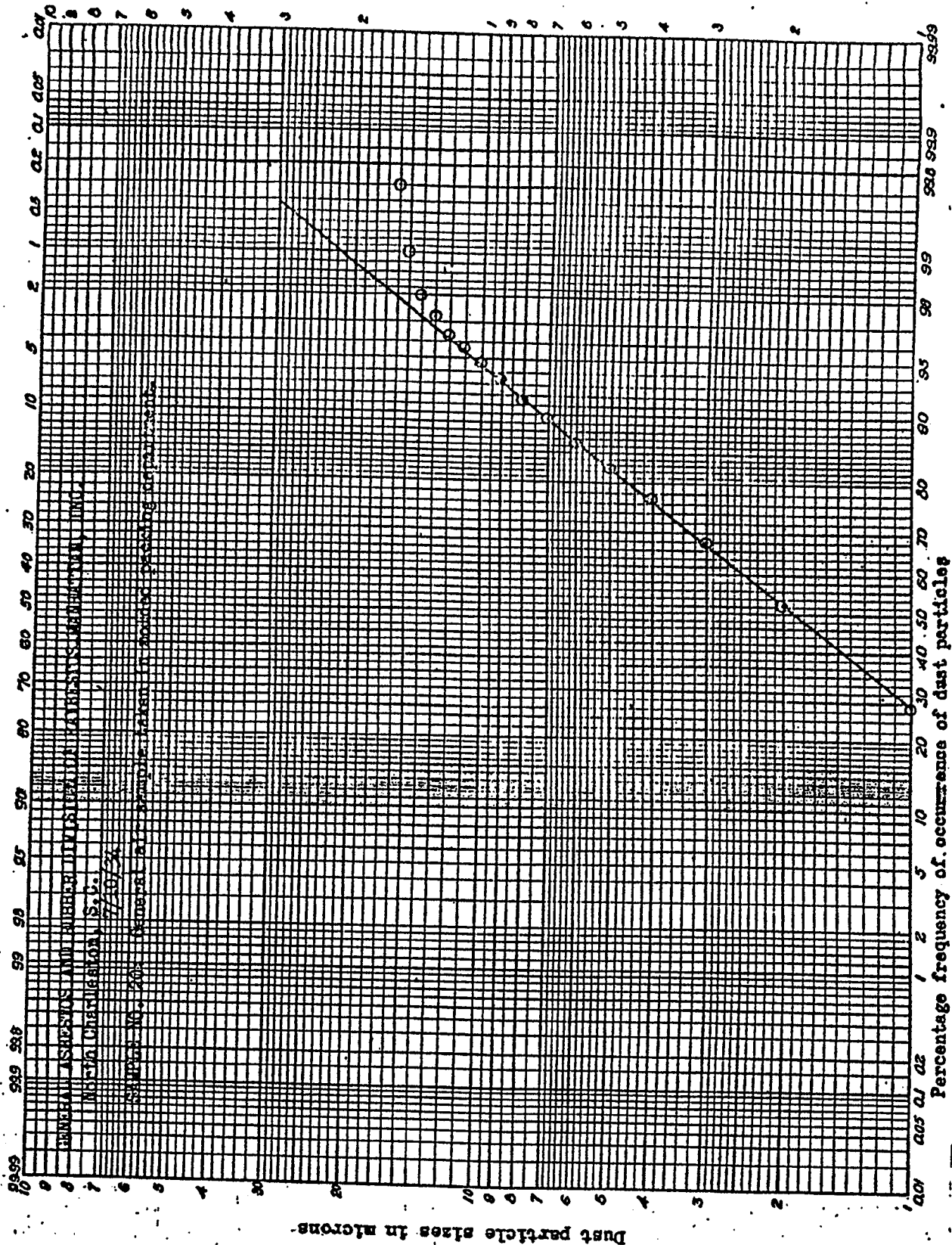
GENERAL ELECTRIC AND RUBBER DIVISION OF GENERAL ELECTRIC CO.  
 WEST CHICAGO, ILL.  
 7/10/54

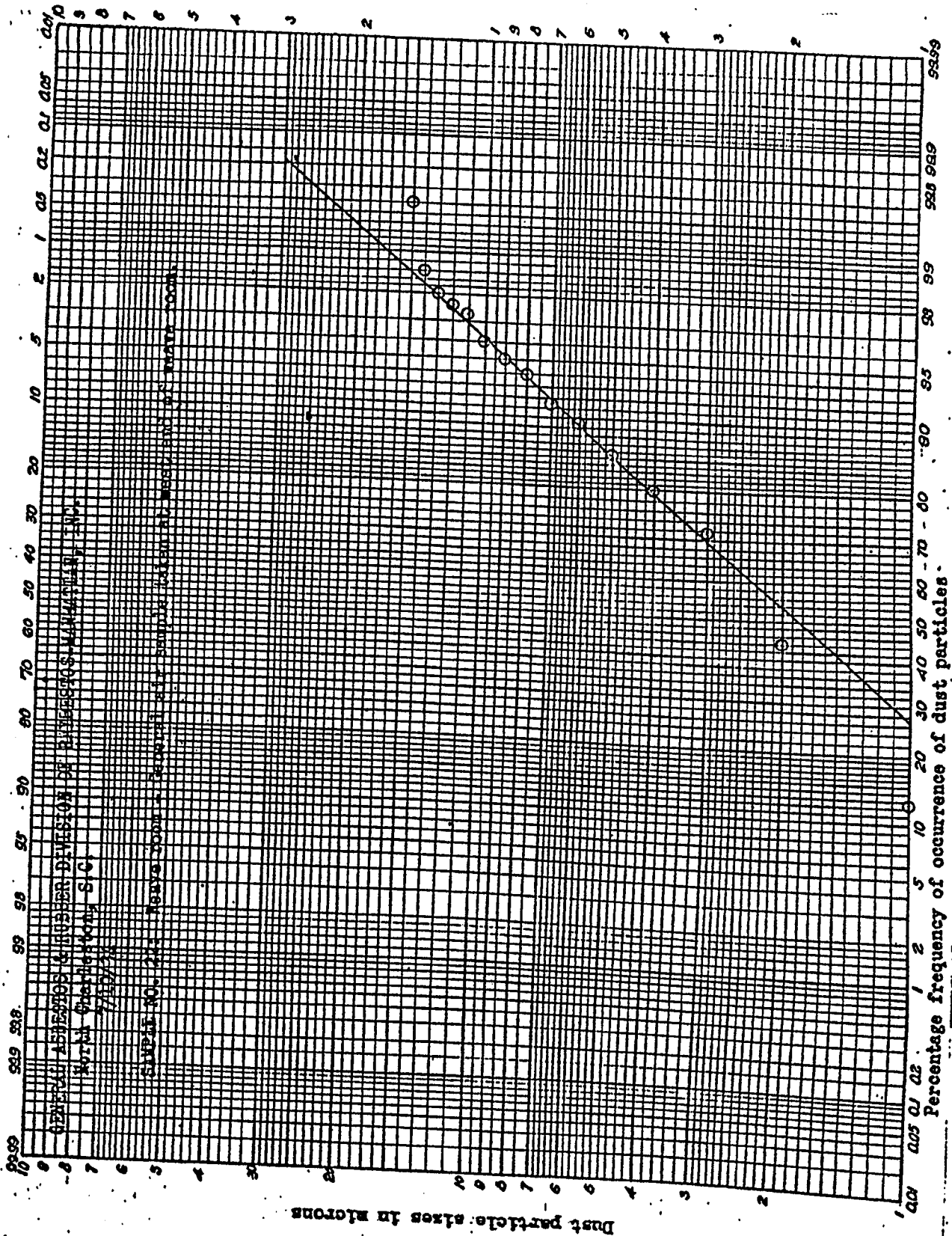
SAMPLE NO. 165 - GENERAL AIR (MOTOR) - TESTED IN A SPECIALTY SHOP FOR FINE TESTS EQUIPMENT

NO. 3128. LOGARITHMIC PROBABILITY. DESIGNED BY HAZEN, WHIPPLE & FULLER.

CORSE BOOK COMPANY, INC. - NORWOOD, MASSACHUSETTS

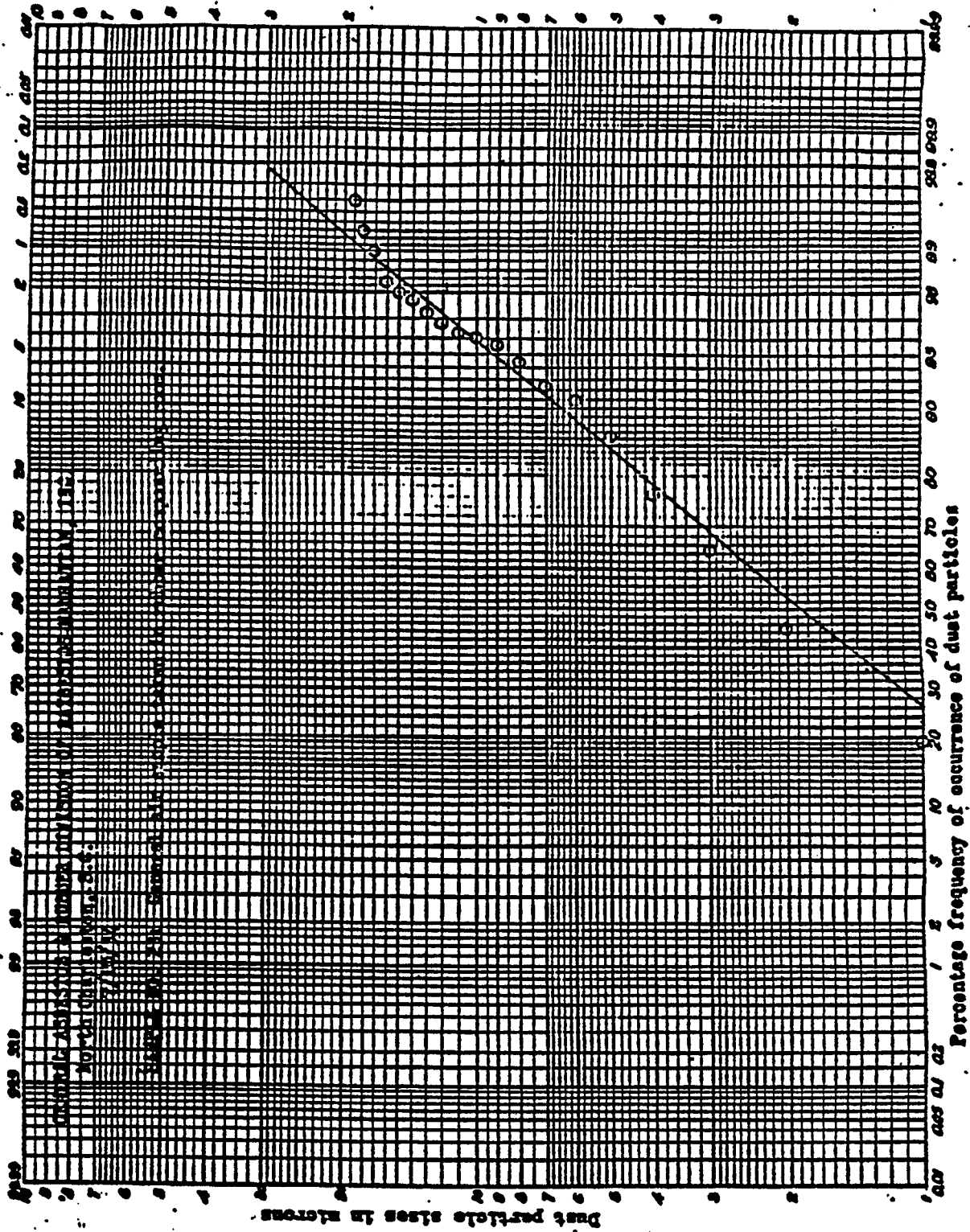






NO. 317d. "LOGARITHMIC PROBABILITY". DESIGNED BY HAZEN, WHITFIELD & FULLER.

MADE IN U.S.A. BY THE BUREAU OF STANDARDS, WASHINGTON, D.C.



NO. 512B. LOG-PROBABILITY PAPER. DESIGNED BY NATHAN WHITFIELD & FULLER.

GOODYEAR RUBBER COMPANY, INC. BOSTON, MASSACHUSETTS

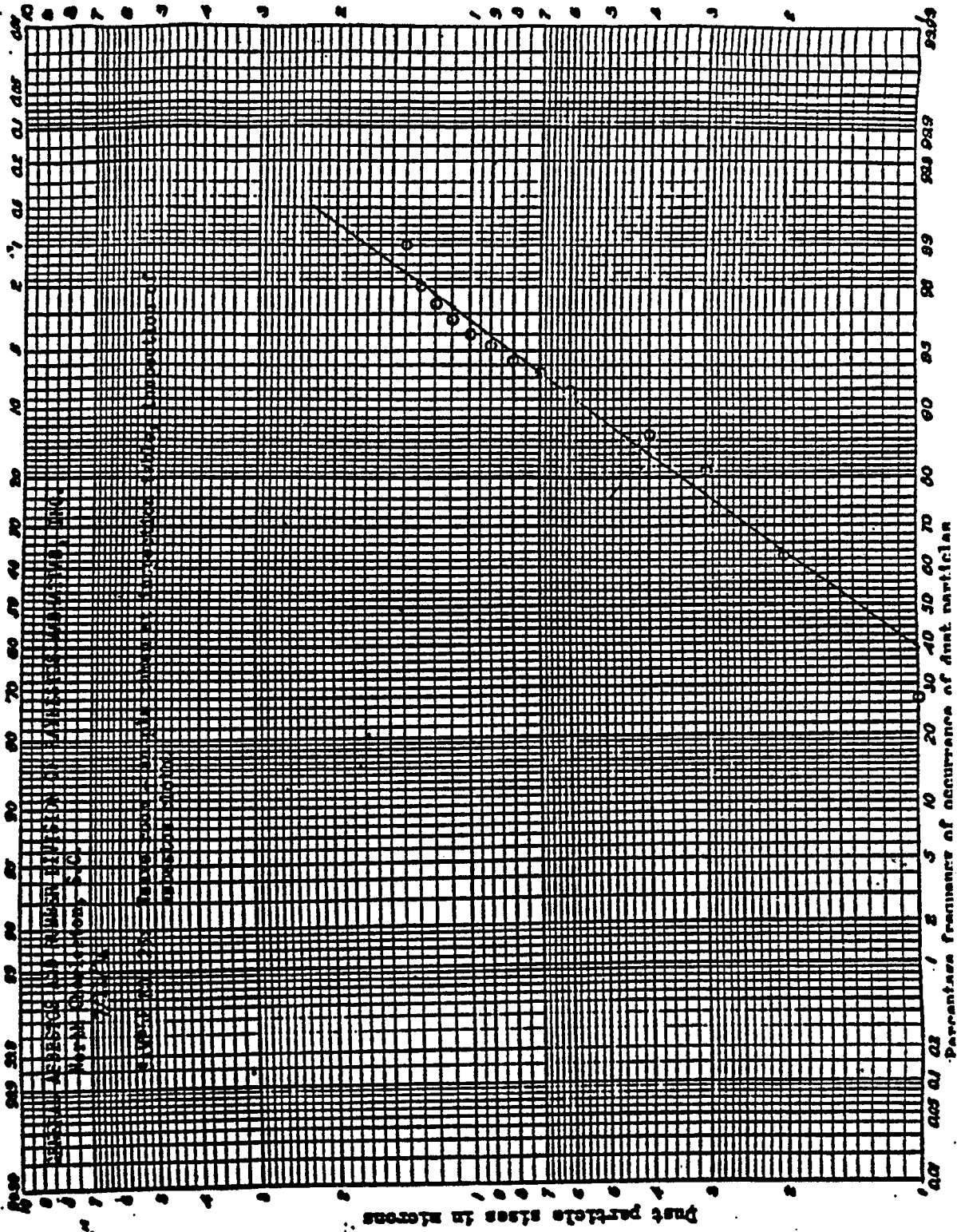
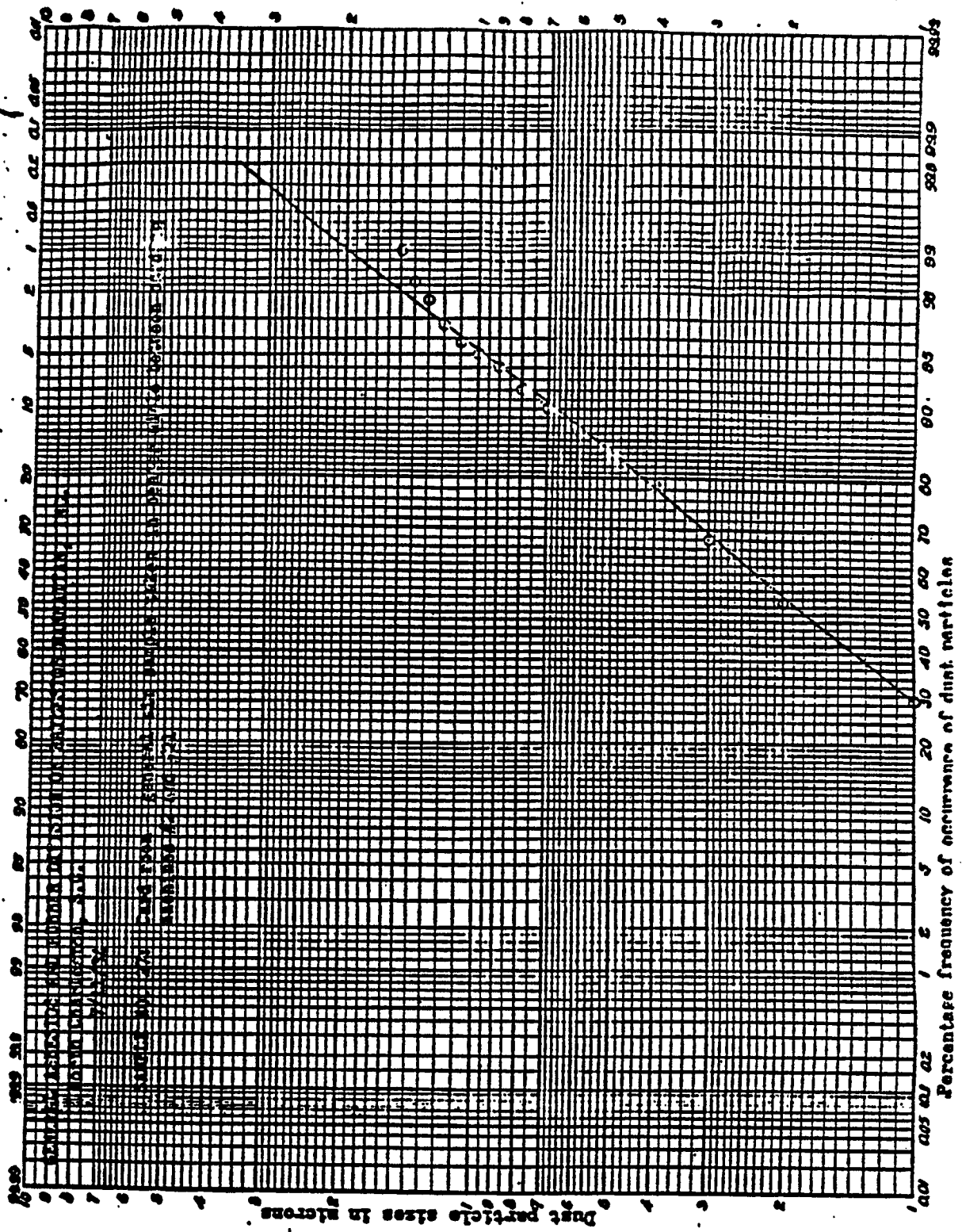
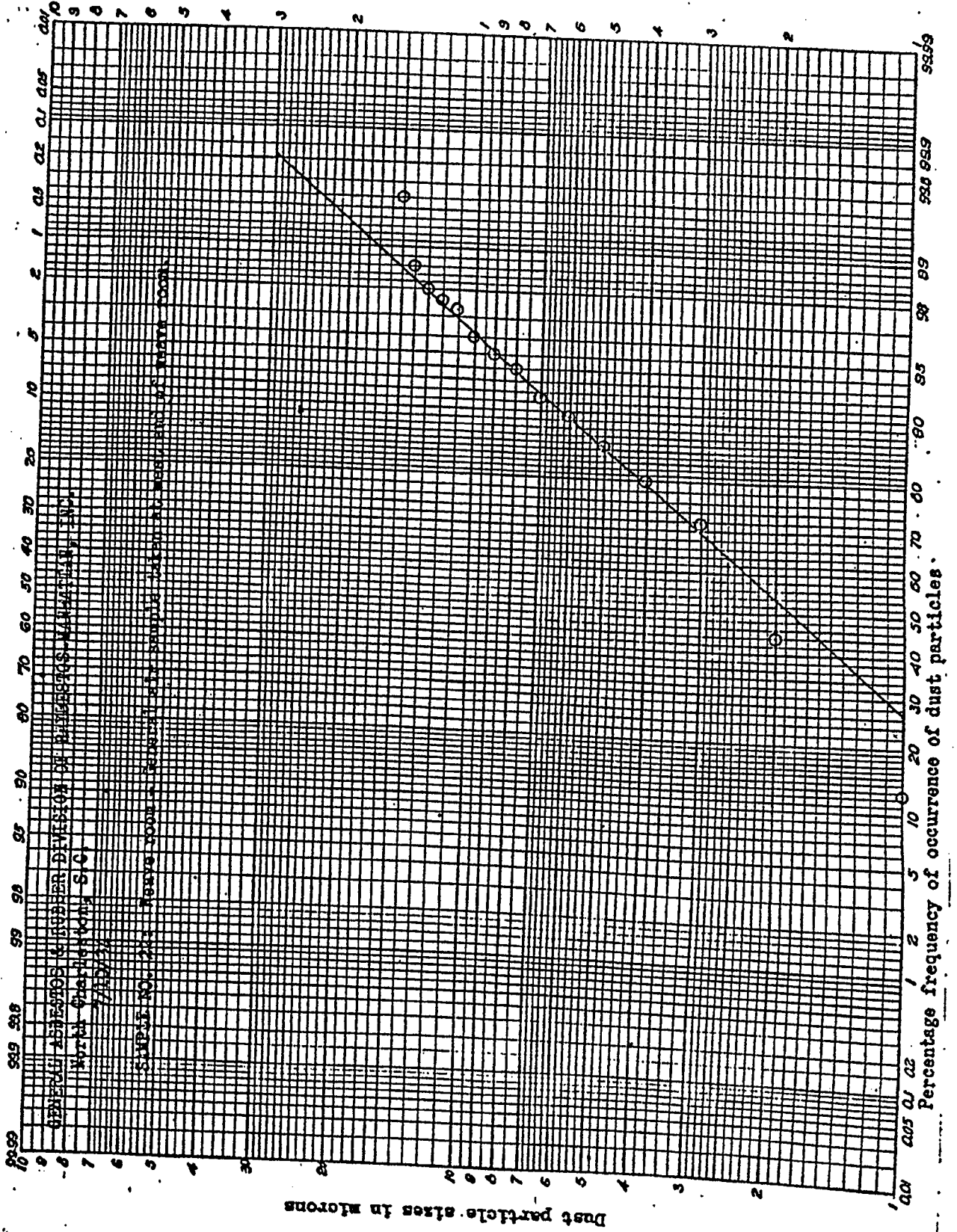
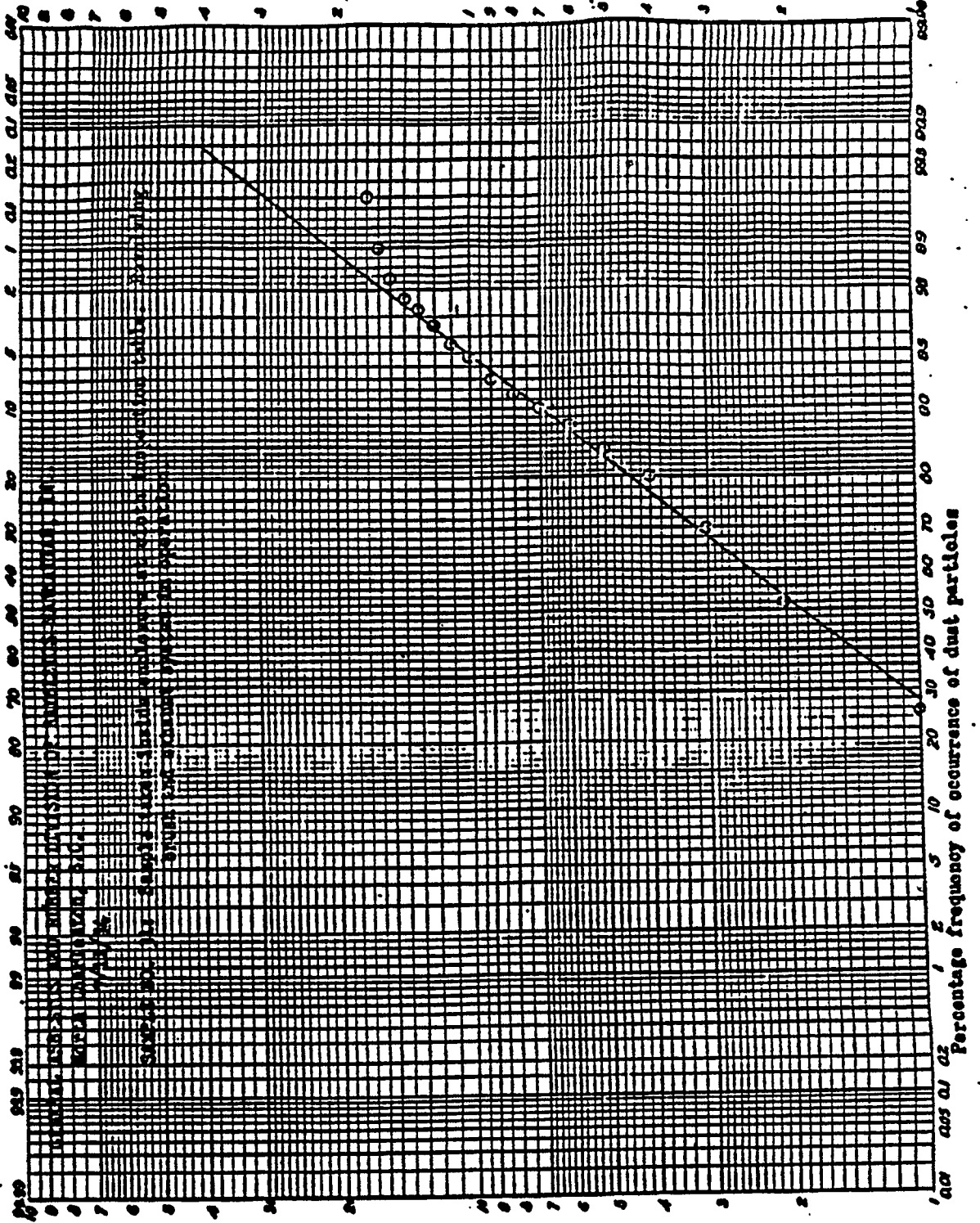


FIG. 3118. LOGAUNTIC PROBABILITY. DESIGNED BY HAZEL, WHITPLE & FULLER.

GEORGE DEERE COMPANY, INC. DETROIT, MICHIGAN

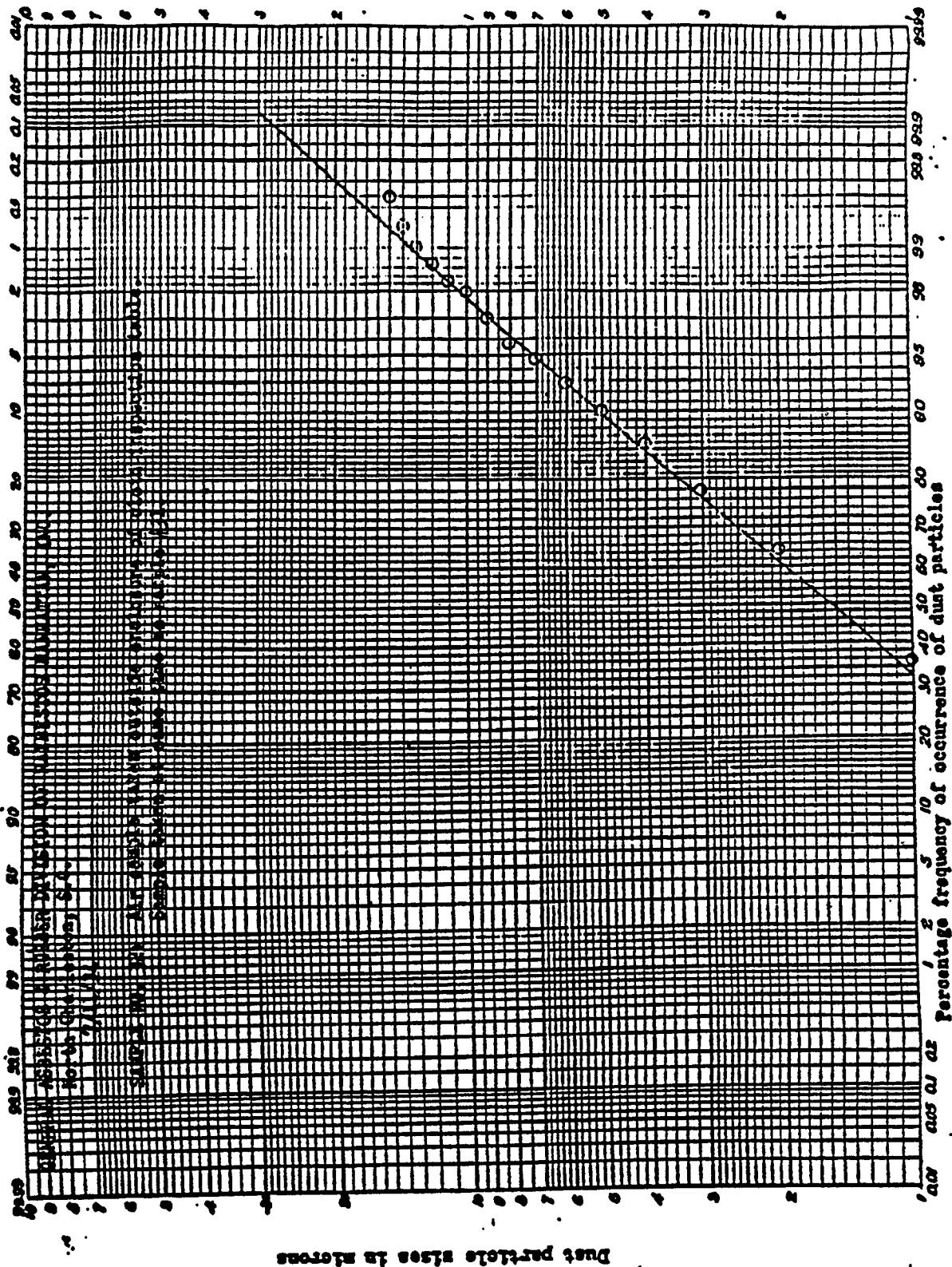






Dust particle sizes in microns

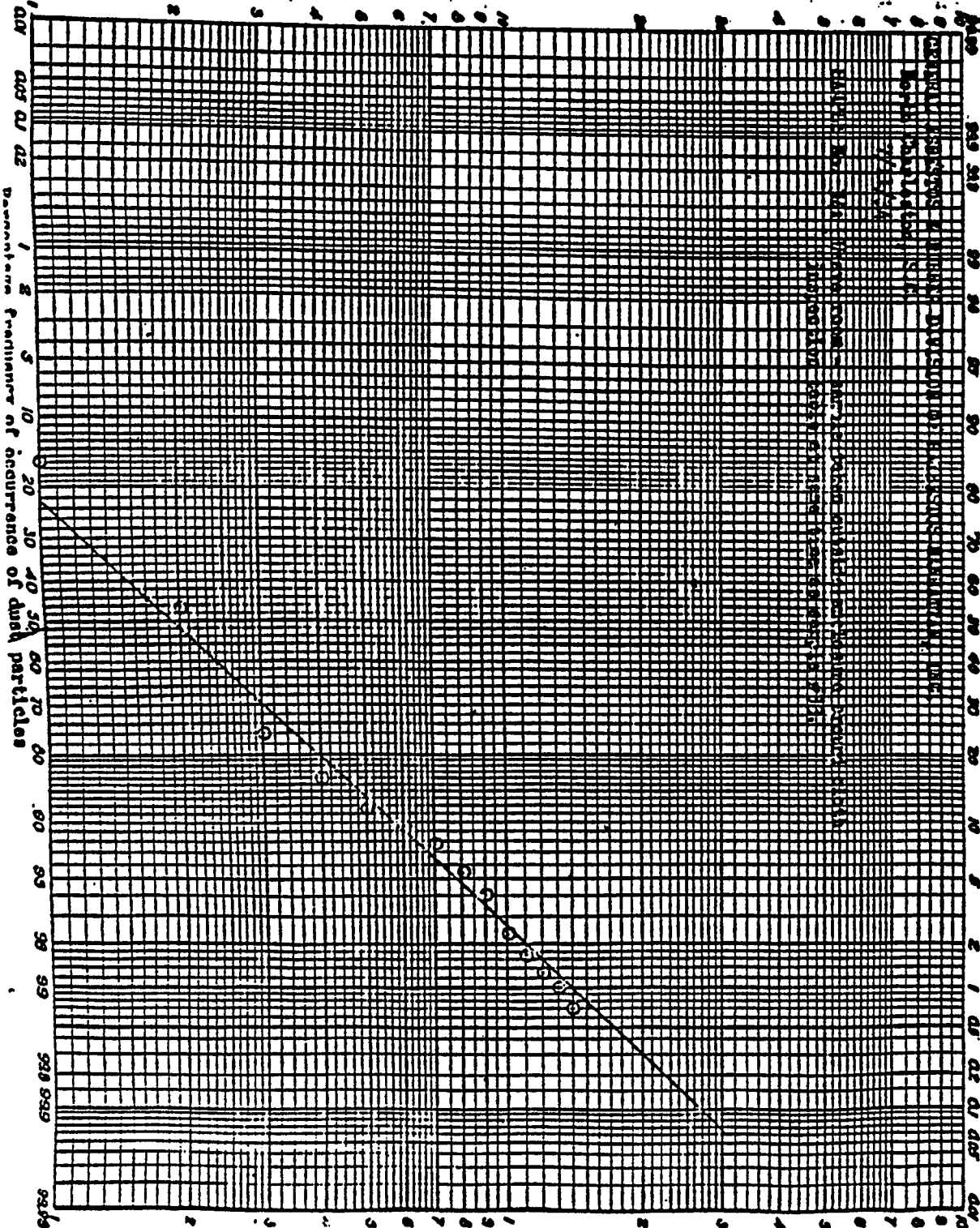
**COHEN BOOK COMPANY, INC.      NORWOOD, MASSACHUSETTS**



**CONTROLO, PLACACHUSERS**

Percentage frequency of occurrence of dust particles

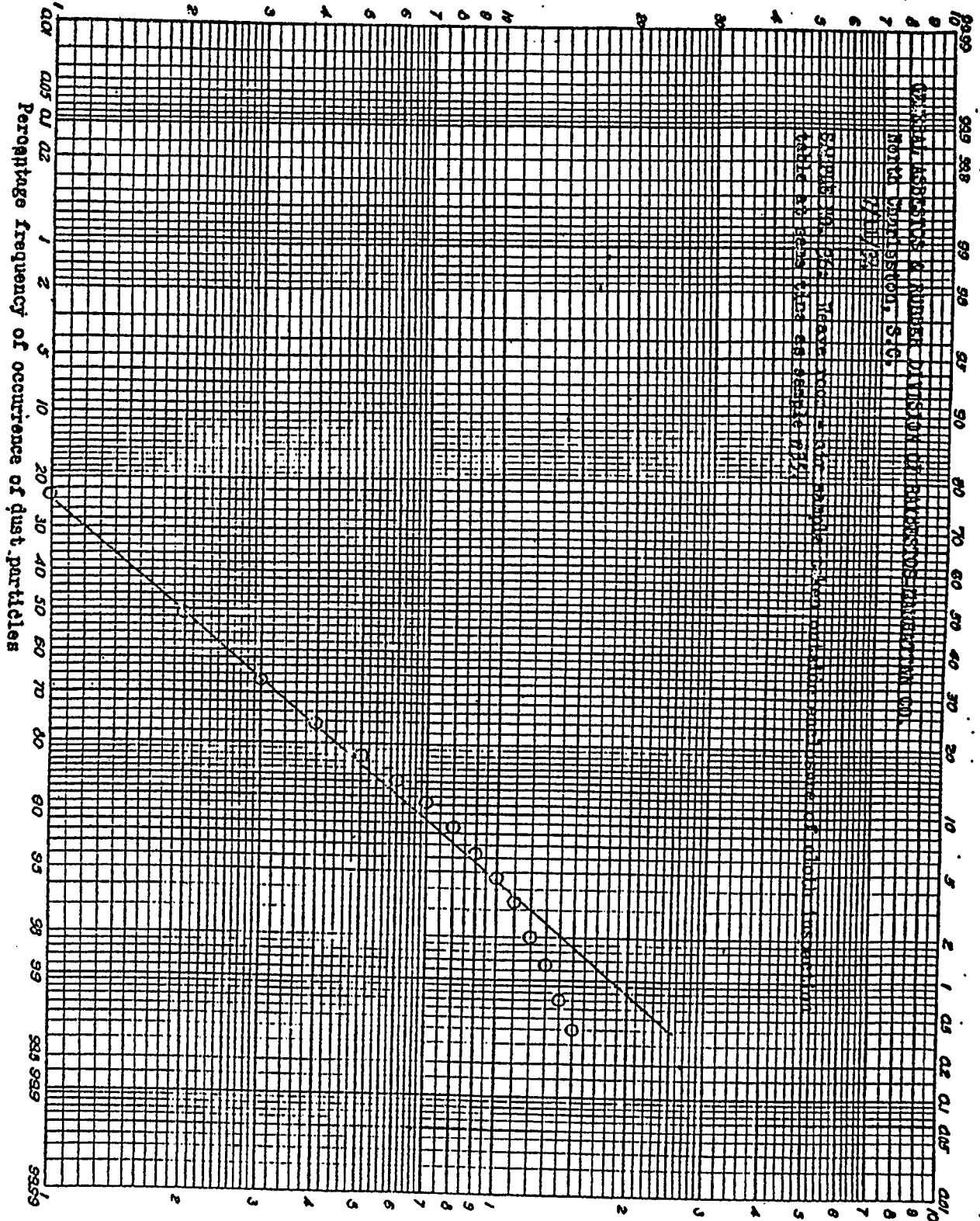
Dust particle sizes in microns.

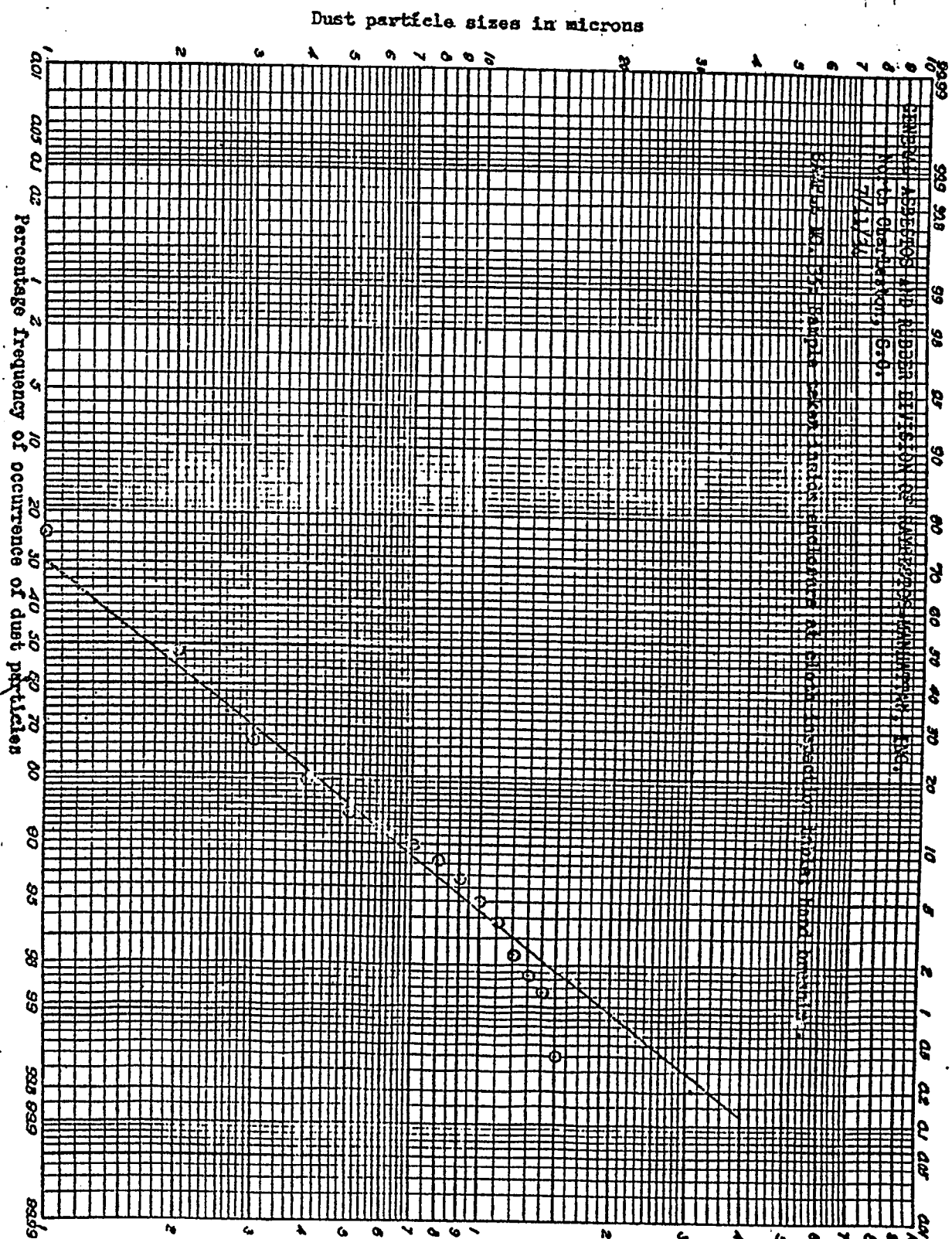


NO. 313. LOGARITHMIC PROBABILITY. SERIES OF PAPER, SIMPLE & FULL.

GEORGE DECK COMPANY, INC. BOSTON, MASSACHUSETTS

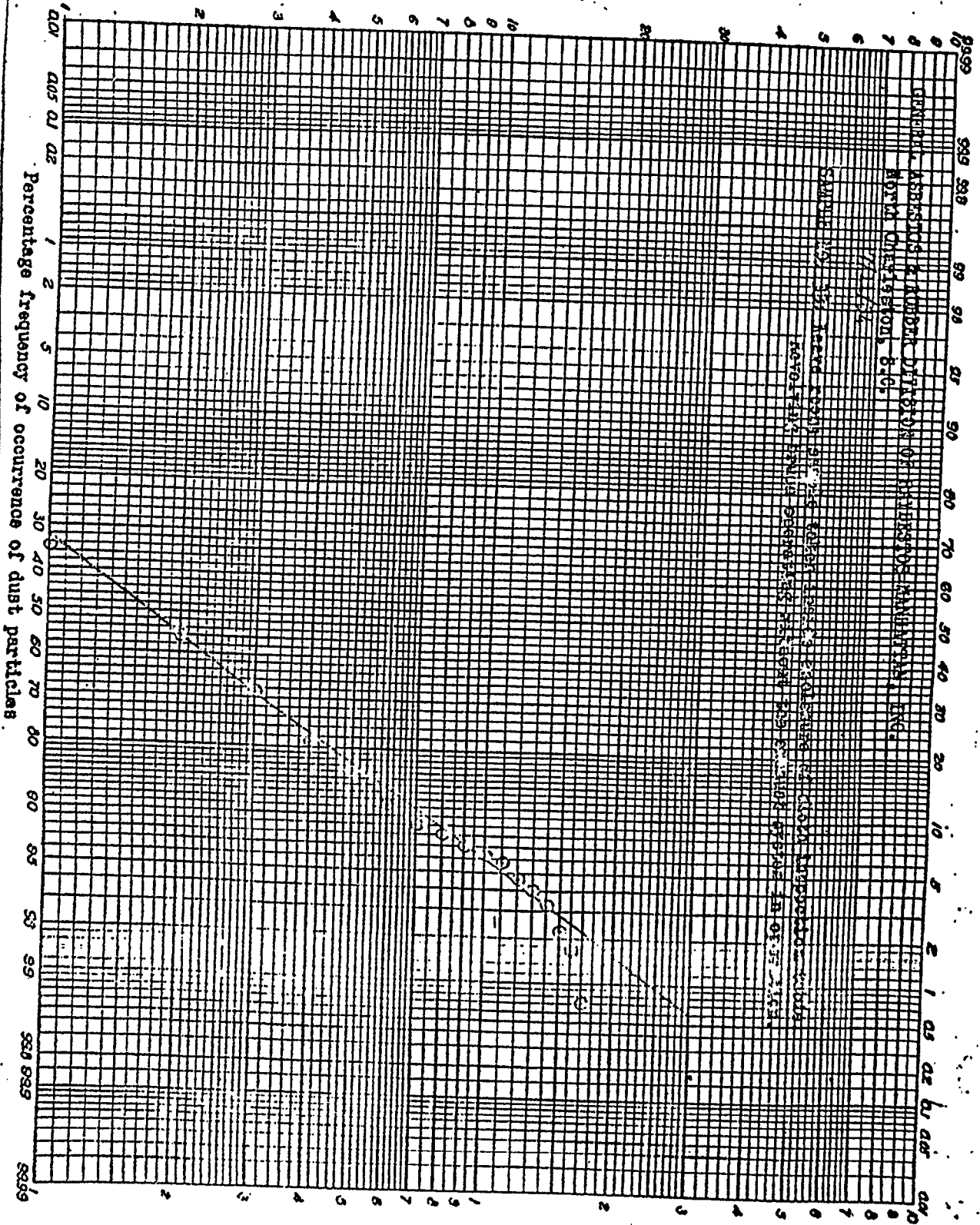
# Dust particle sizes in microns





[illegible]

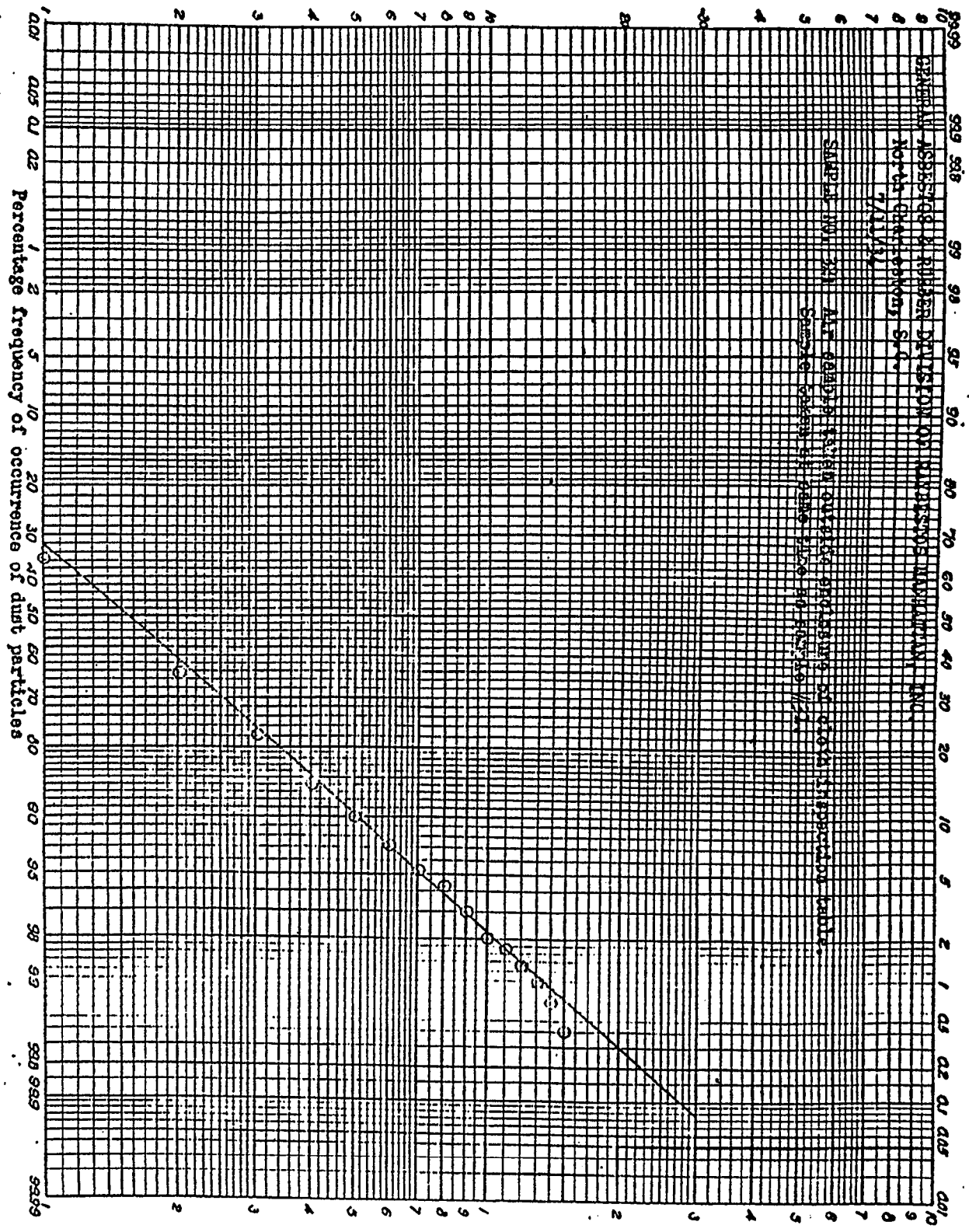
# Dust particle sizes in microns



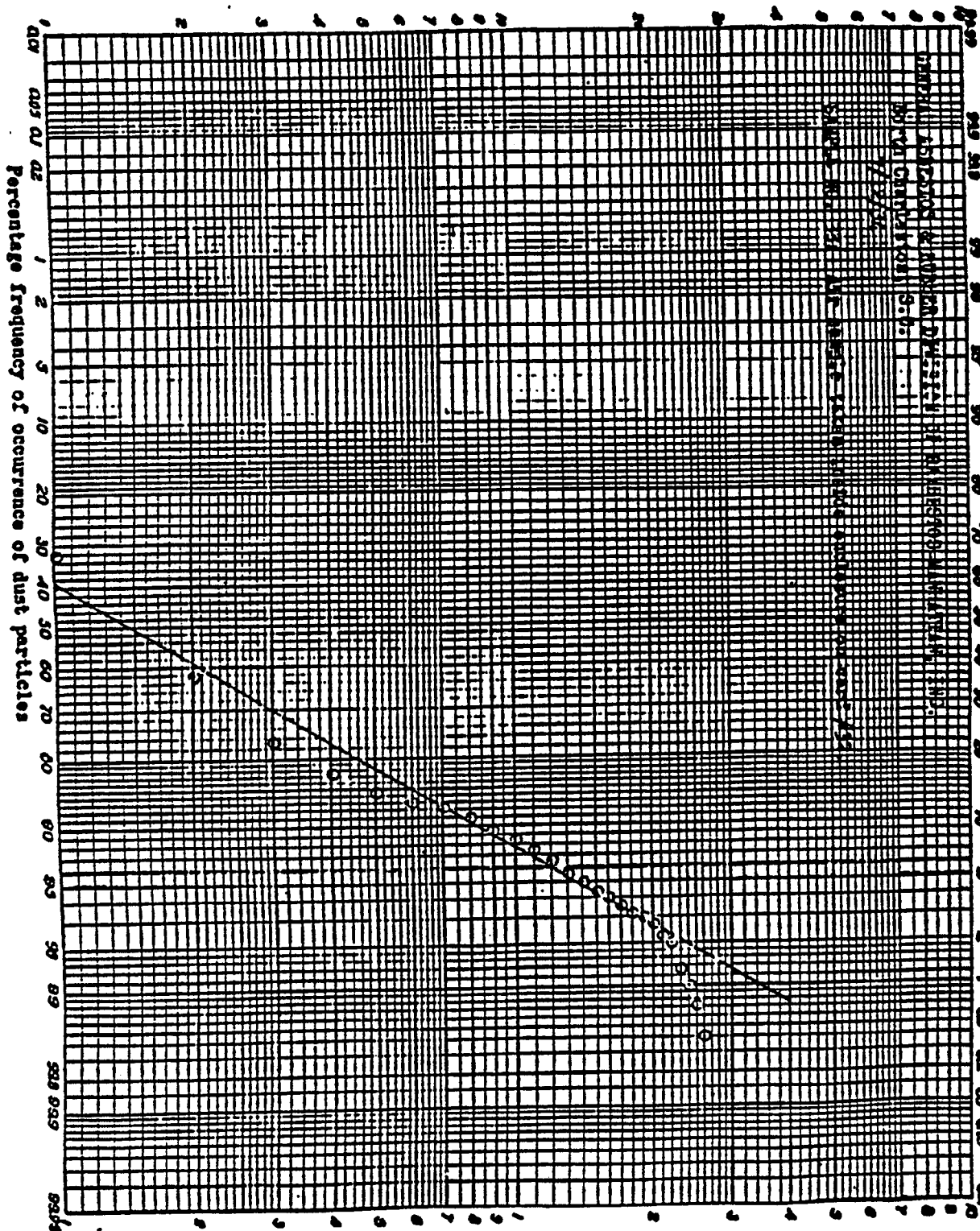
# Dust particle sizes in microns

DESIGNED BY WILLIAM FULLER

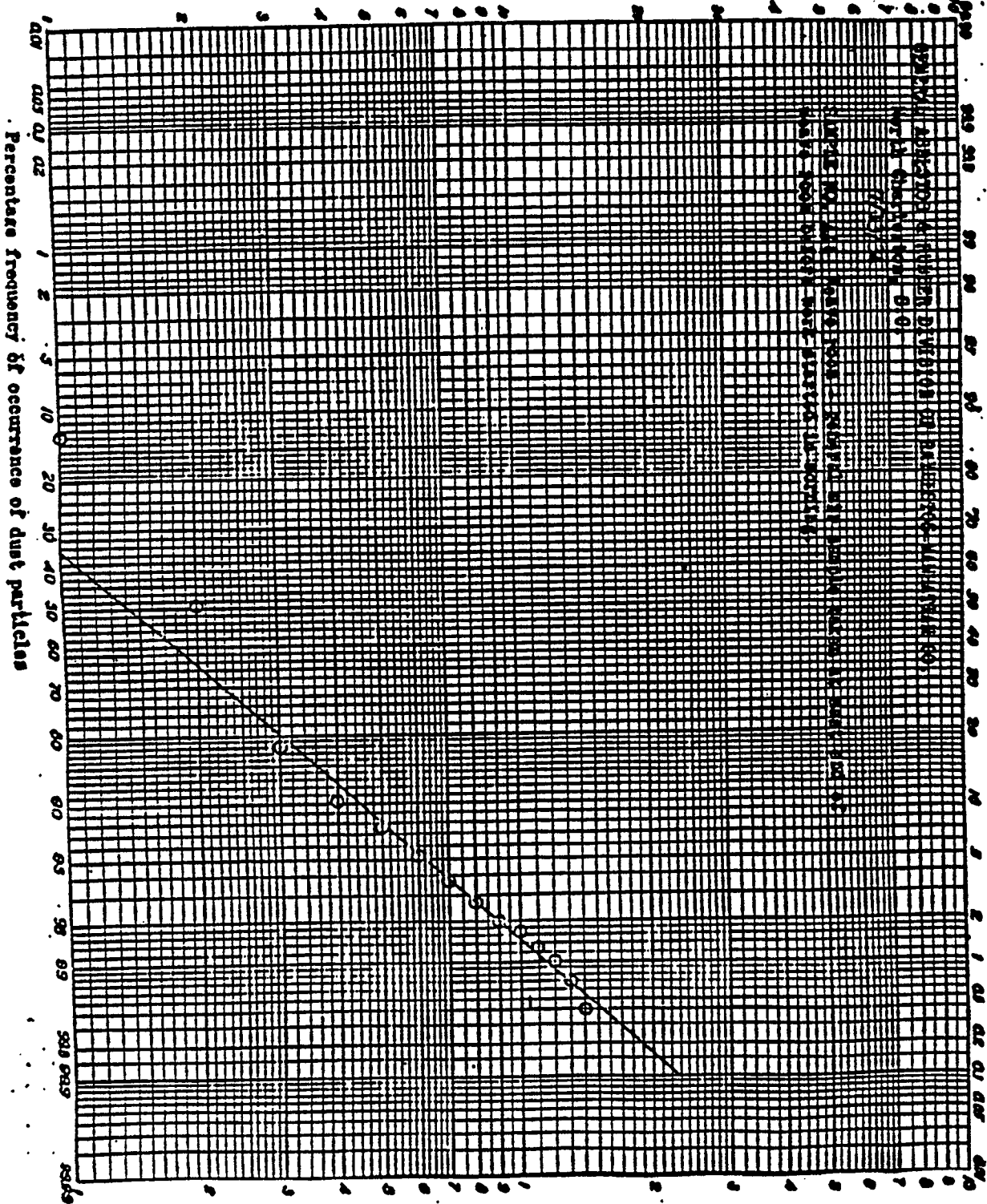
COOK BOOK COMPANY, INC. NORWOOD, MASSACHUSETTS



# Dust particle sizes in microns

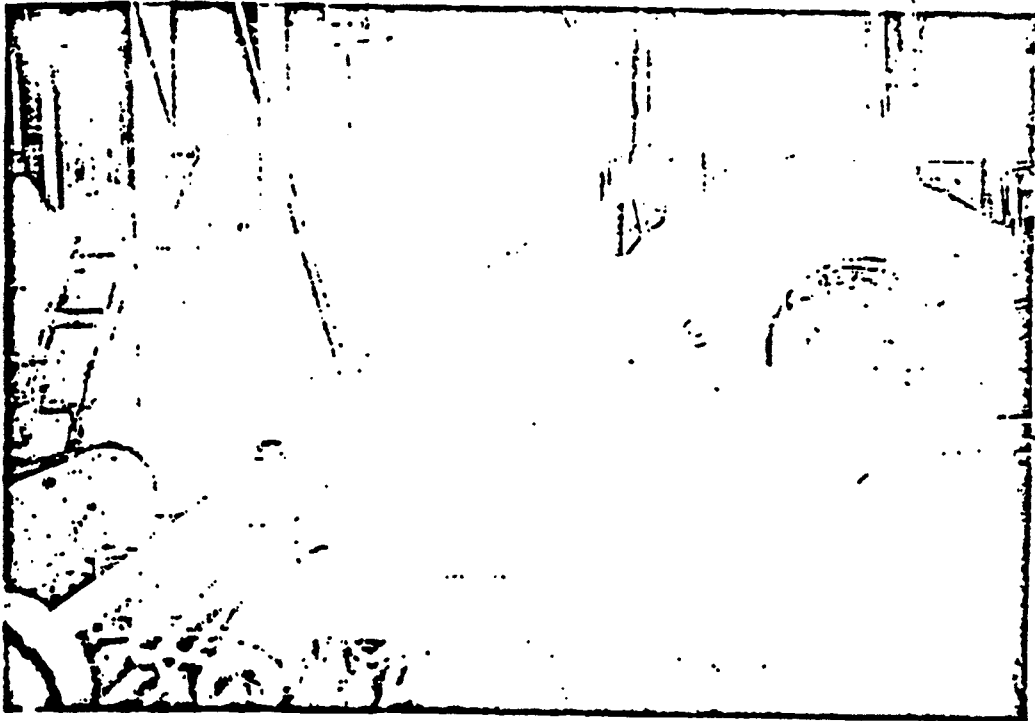


Dust particle sizes in microns.



12-B

12-B



Card Room.

General Asbestos & Rubber Division  
Raybestos-Manhattan, Ind.  
Charleston, S.C.

14-B

14-B



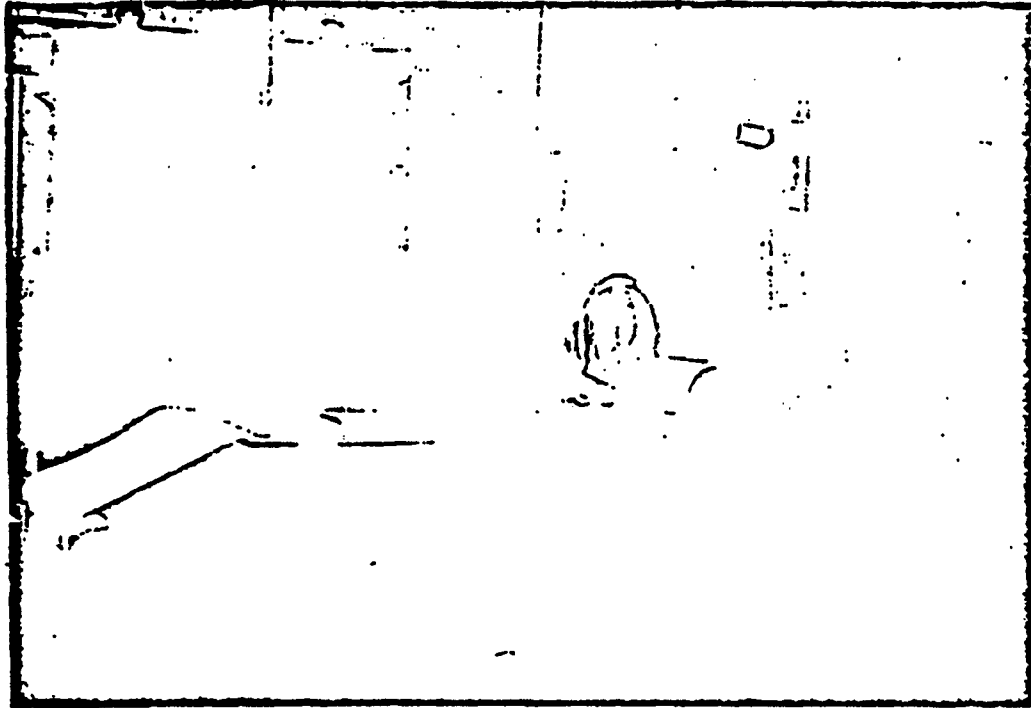
SAMPLES NO. 31, 32, 33, 34, 35 and 36

Enclosure built around table inspection  
of woven cloth in weave room

General Asbestos & Rubber Division  
Raybestos-Manhattan, Inc.  
Charleston, S.C.

13-B

13-B



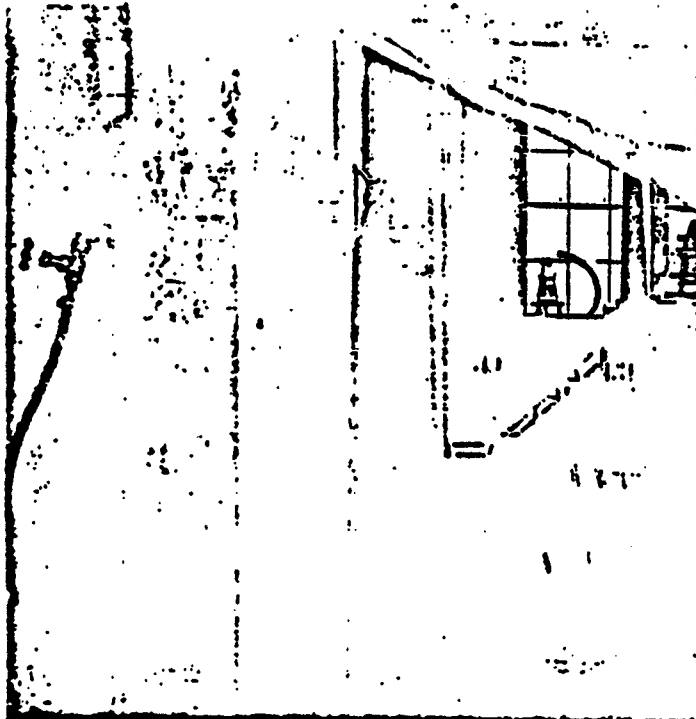
SAMPLES NO. 25, 47, 50 and 53

At inspection table - woven cloth

General Asbestos & Rubber Division  
Raybestos-Manhattan, Inc.  
Charleston, S.C.

15-B

15-B



SAMPLE NO. 38

One card inside muslin enclosure

General Asbestos & Rubber Division  
Raybestos-Manhattan, Inc.  
Charleston, S.C.