XXXV.—REPORT OF OPERATIONS AT THE NAVY-YARD SHAD HATCHING STATION IN WASHINGTON, D. C., DURING THE SEASON OF 1882.

By Lieut. W. M. Wood, U. S. N.

I have the honor to make the following report of the shad-hatching operations carried on at this station:

The station is at the navy-yard, Washington, in the east wing of the boat-house, which forms a large room, having in the center an opening to the water large enough to hoist a boat. The apparatus used was the Ferguson cones. These were forty-eight in number, arranged in eight parallel rows on each side of the open space in the center. The pressure of water was supplied from the city mains, the discharge emptying into the river. The room was lighted by four double windows on the east side and one on the north side. As the season advanced it was found that the cones on the western or dark side yielded nearly 50 per cent. less than those on the eastern side. The eggs in these cones formed in clotted masses that soon emitted a noxious odor, and quickly killed any young fish that hatched. On the 24th of May two large windows were cut on the southern side of the room, admitting much more light and sun. The effect of this was soon appreciable, the western side yielding as good results as the other. Thirteen of the cones on the western side were provided with a new goose-neck, in which the small jet pipe used in the others was omitted. These cones continued to yield bad results, even after the windows were cut, although in some cases the wire-gauze top of the goose-neck was removed.

The steamer Lookout and a Herreshoff steam-launch were attached to the station, making daily trips to the fishing grounds for eggs. The first shad eggs, 40,000 in number, were taken on the 19th of April, and the first shipment of young fish was made the 3d of May to the Sandusky River, Ohio. The weather until May 17 was cold, damp, and rainy, the temperature of the water not being higher than 60° F. at any time, which has been deemed exceedingly unfavorable. The fish hatched took a period of nearly ten days, and seemed quite weak. As the water grew warmer this period gradually decreased. On the 20th of May to eight days, temperature of water 63°; on the 1st of June to six days, temperature of water 69°; and on the 7th of June to four days, temperature of water 70° and 71°.

Although the fishing season began quite early, the cold and rainy weather, with an unusual rise of the river on several occasions, at one

time 6½ feet, soon disheartened the seine fisherman, who began to "cut out." On the 25th of May the seine at Bryant's Point "cut out," and on June 1 the seine at Moxley's Point also "cut out," leaving the gill-net fisherman as the only means of obtaining spawn.

The greatest number of spawning fish taken at one time was at Moxley's Point, May 10, when 31 females and 30 males were taken in a haul of 250 shad. The greatest number of eggs taken in one day was on April 27, when 1,590,000 shad eggs were obtained. Unfortunately, 600,000 of this number were lost by being put into a new tin vessel, which may have contained some small portion of muriatic acid in the solder, although it had been carefully scrubbed. Putting a large number of newly impregnated eggs into a single vessel seems questionable, and may in some measure account for the loss.

A leather carp, weighing from 3½ to 4 pounds, was taken in the seine off Moxley's Point, and on June 1 a female shad weighing 1½ pounds, 13 inches long, and about two years old, was taken, and yielded spawn quite freely. This fish was sent to the National Museum for preservation.

The seine fisheries visited were situated on the eastern bank of the Potomac as far down as Marshall Hall. Most of the eggs were taken at Moxley's Point, owned by Mr. J. H. Skidmore, of Washington. The shoal water there seemed to be the favorite resort of spawning fish. Seventy per cent. of the entire number of eggs were taken here, the seine at Bryant's Point and the gillers off Fort Washington supplying the remainder.

The haul-seine at Moxley's Point, owned by Mr. J. H. Skidmore, is 300 fathoms in length, 25 feet in depth; size of meshes 1 inch to 1½ inches. Total cost of net and roping, $735; seine, boat, and outfit, $360; two capstans, $50 each; making total cost of equipment about $1,200. Twenty-five men were employed here at $25 per month each and their board, which cost about 20 cents per day. In addition to these, four foremen were employed, at sums varying from $100 to $200 apiece for a season of seven or eight weeks. Getting the fish to market costs about $7 a day. In addition to the above, three horses were employed to haul the seine. Four hauls were made on each ebb-tide, the flood haul being omitted, owing to the fact Mr. Skidmore did not own the ground below the haul.

The fishery at Sandy Bar, where a good many of the eggs were taken last season, "cut out" after ten days' fishing.

There are twenty-six gill-net fishing-boats between the Eastern Branch and Marshall Hall, two men in each boat; the gill-nets being from 100 to 250 fathoms in length, 24 feet in depth; size of meshes, 5¼ inches; the cost of a 100-fathom net is $35; boat and outfit $100; the total cost of outfit being $135. The men employed receive $1 per day; the boats and nets being the property of the men fishing them.

There were fifteen pound nets visited, costing $150 each, the expense

of each net being $60 a month. They require three men and a boat to tend each net, needing great attention, as any sudden rise in the river may wash them away, unless they are hauled up clear of the water. Pound nets this season caught an unusually small number of fish, especially shad, which fishermen ascribe to the prevailing muddy water and freshets.

Several attempts have been made to hatch herring at this station, but with unfavorable results. When the spawn was taken the temperature of the water was so low as to retard their development. On one occasion 3,000,000 herring eggs were obtained, the cold water killing the young fish as soon as hatched.

The jar invented by Col. Marshall McDonald has been used with success on several occasions, the period of hatching being the same as the cones. The eggs taken after the 1st of June turned out badly, a large number of females being found, but no males, so that it was impossible to impregnate the eggs.

The fishing season this year has been unfavorable, owing to the causes previously mentioned, a low temperature of the water and successive freshets.

From the market reports of Washington the following information has been gathered in regard to the total catch of shad and herring in the Potomac for 1881 and 1882, to the 1st of June inclusive:

Months.	Shad.		Herring.	
	1881.	1882.	1881.	1882.
February	40	18	1,000	793
March	5,432	11,639	117,173	40,709
April	237,469	233,444	2,710,496	3,074,162
May	196,928	97,094	5,633,014	3,108,678
Total	439,869	342,195	8,461,683	6,224,337

The following is a recapitulation of the work done from April 19 to June 8, 1882, on which day the station was closed:

Total number of shad eggs received	21,820,000
Total number of shad fry hatched	17,935,000
The per cent. being	82.19

There have been 3,050,000 shad fry put into the Eastern Branch of the Potomac at this station; 1,710,000 into the Potomac at Little Falls; the remainder, 13,175,000, being sent to the Central Station for distribution.

Accompanying the report is the daily journal kept at the station: A form containing the meteorological observations taken three times daily; a form containing the record kept by the spawn-takers stationed at Moxley's Point.

The apparatus designed by me to operate hatching cylinders by means of any small stream of water with slight fall was developed and put in

operation at this station with very promising results. The water used as a motive power was the waste from the cones, and consequently clear gain. The annexed sketch (Plate I) will give a good idea of the apparatus as used here.

A float, A, was built just the size of the slip in the boat-house, the T-ends acting as guides as it rose and fell with the tide. Uprights were erected at each end and in the middle; between these, resting in suitable bearings, were placed the shafts B of 2½-inch iron pipe. Into these main shafts were screwed short pieces of pipe, C, as arms to carry the hatching cylinders. Directly opposite but near the outer end a similar arm, D, was placed to carry the trip-bucket E. This arm has also a movable weight, F, which is used to counterbalance a greater or less number of cylinders by moving it either direction. The waste water was carried over the trip-buckets by suitable pipes.

The operation of the apparatus was as follows: The bucket gradually filling the increasing weight caused it slowly to descend, the cylinders on the opposite side being correspondingly raised. When the bucket filled to the projecting spout shown in sketch, the balance being destroyed it pitched to the front, and, emptying itself, immediately returned by means of a counterbalanced bottom, to the vertical position again. The effect of this sudden emptying destroyed the balance between the rising cylinders on the one hand and the counterbalanced arm on the other, the cylinders plunging back to the position they first occupied. This of course repeats itself indefinitely. The rise and fall each way was regulated by a small guy line. The movement of the cylinders keeps the eggs constantly in motion and gives excellent results.

For hatching floating eggs, such as those of the Spanish mackerel, I would suggest that sufficient agitation and change of water might be had by simply moving the float where it would be acted upon by the waves. This float is very buoyant, as it is composed largely of casks, and dances about at the slightest provocation.

In conclusion, I beg to say that I have been ably assisted in the management of this station by Masters W. C. Babcock and A. C. Baker, United States Navy, under whose direct care the hatching-house operations have been conducted.

Record of spawning operations conducted at Moxley's Point, on the Potomac, from April 19, 1882, to June 8, 1882, by B. G. Harris, spawn-taker.

Date.	Number of shad taken.	Number of herring taken.	Pounds of rock taken.	Ripe fish.		Eggs obtained.	Fish hatched.
				Males.	Females.		
1882.							1882.
April 19	*627					40,000	April 29.
20	707					155,000	April 30.
21	400					80,000	May 1.
22	286					205,000	May 2.
23	861						
24	493					500,000	May 3.
25	666					300,000	May 3.
26	360					500,000	May 4.
27	276					1,500,000	May 5, 6.
28	461					800,000	May 7.
29	283					300,000	May 8.
30	160					120,000	May 9.
May 1	360					445,000	May 10.
2	377					360,000	May 10.
3	182					280,000	May 11.
4	243					385,000	May 12.
5	288					730,000	May 13.
6	387	4,700	3	14	14	980,000	May 14.
7	248	13,000	13	15	12	500,000	May 15.
8	73	5,000	6	10	8	240,000	May 16.
9	56	7,000		5	4	110,000	May 18.
10	250			31	31	760,000	May 18.
11	90			2	1		
12	39	17,000		15	10	500,000	May 21.
13	71	3,000		16	12	400,000	May 22.
14	275	600					
15	170	1,000		15	12	50,000	(*)
16	44	1,500		16	13	350,000	May 23, 24.
17	214	2,000		13	10	280,000	May 25.
18	336	4,000		30	31	450,000	May 26.
19	128	8,000		3	3	400,000	May 27.
20	188	15,000		1	1	400,000	May 27.
21	62	18,000		2	2	40,000	May 28.
22	87	25,000		5	4	100,000	May 29.
23	16	5,000	3	2	2	40,000	May 30.
24	55	7,000		5	4	80,000	May 31.
25	40	2,000		2	3	70,000	June 1.
26	50	3,000		4	5	100,000	June 1.
27	187	5,000		6	6	200,000	June 2.
28	15	5,000	15	4	5	150,000	June 3.
29	40	7,000	6	10	12	300,000	June 4.
30	90	2,000		3	4	80,000	June 5.
31	175	1,000					
June 1	360			6	5	80,000	June 6.
2							
3	80			6	5	80,000	June 7.
4	20						
5	100			7	8	200,000	June 8.
6	130			4	3	80,000	June 9.
7	150			5	6	140,000	June 10.
8	115			5	5	120,000	June 10.

*Eggs transferred to Fish Hawk.

NOTE.—From April 19 to June 1 the length of haul-seines visited daily was 800 fathoms, and the length of gill-nets visited daily from June 3 to 8 was 5,200 fathoms.

Record of meteorological observations made at navy-yard, Washington, on the Eastern Branch of the Potomac, by Masters William C. Babcock and Asher C. Baker, United States Navy.

APRIL 25 TO MAY 11, 1882.

Date.		Temperature of—									Wind.						Condition of—				State of—			Remarks.
Day of week.	Day of month.	Air.	Surface water.	Bottom.	Air.	Surface water.	Bottom.	Air.	Surface water.	Bottom.	Direction.	Intensity.	Direction.	Intensity.	Direction.	Intensity.	Sky.	Sky.	Sky.	Water.	Tide.	Tide.	Tide.	
Tuesday	April 25	55	55	54	55	55	54	57	55	55	N.	1	W.	1	NE.	1	b. c.	b. c.	b. c.	Clear.	Ebb.	Low.	Flood.	Clear and cool.
Wednesday..	April 26	55	55	55	66	56	54	58	56	57	SE.	1	SE.	1	NE.	1-2	b. c.	c.	c. r.	..do ..	..do ..	Flood.	Ebb.	Cloudy and rainy.
Thursday....	April 27	55	55	55	52	55	55	62	56	56	NE.	1	N.	1	E.	3	o. c.	r.	b. c.	..do ..	..do ..	..do ..	..do ..	Partly cloudy, with light rain; changing to fair weather.
Friday.....	April 28	62	56	56	68	56	56	62	56	56	S.	1	S.	3	S.	1	c. m.	c.	b. c.	..do ..	Flood.	Ebb.	Flood.	Cloudy and warm.
Saturday ...	April 29	56	56	62	58	58	58	62	58	58	NE.	1	E.	2-3	E.	2	o. c.	o. c.	b. c.	..do ..	Ebb.	..do ..	Ebb.	Overcast; clearing after sunset.
Sunday	April 30	63	58	57	68	58	58	62	58	58	NW.	2-3	NW.	2-3	NW.	1	b. c.	b. c.	b. c.	..do ..	Flood.	..do ..	Flood.	Clear and pleasant.
Monday	May 1	58	58	58	71	59	61	68	59	59	Calm.	0	NW.	2-3	NW.	1-2	b. c.	b. c.	b. c.	..do ..	High.	..do ..	High.	Clear, warm, and pleasant.
Tuesday.....	May 2	64	60	59	66	59	61	56	59	59	NW.	2-4	N.	3-4	Calm.	0	b. c.	b. c.	b. c.	..do ..	..do ..	..do ..	Ebb.	Clear and warm; cool at night.
Wednesday..	May 3	56	58	59	64	59	59	62	60	59	N.	1	SW.	1-2	SW.	1-2	b.	b. r.	b. c.	..do ..	Flood.	..do ..	Flood.	Partly cloudy; cool weather.
Thursday....	May 4	64	60	60	70	61	60	72	60	60	S.	1-2	S.	2	SW.	1-2	b. c.	b. c.	b. c. p.	..do ..	..do ..	..do ..	..do ..	Partly cloudy; passing showers.
Friday.....	May 5	64	60	60	64	60	60	64	60	60	Var.	0-1	NE.	1-2	NE.	1-2	o. c. r.	o. c. r.	o. r.	..do ..	..do ..	Flood.	..do ..	Cloudy, cold, and rainy.
Saturday	May 6	59	60	60	58	60	60	59	59	59	NE.	1-2	NE.	2	NE.	1-2	o. c. d.	o. c. r.	o. c.	..do ..	..do ..	Ebb.	..do ..	Overcast and rainy.
Sunday	May 7	54	59	59	56	59	59	56	59	59	NE.	1-2	NE.	1	Calm.	0	o. r.	o. c. p.	o. c.	..do ..	..do ..	..do ..	..do ..	Overcast; passing showers.
Monday	May 8	56	58	58	60	58	58	59	58	58	NE.	1-2	NE.	1-2	NE.	1-2	o. c.	o. c. d.	o. c. p.	..do ..	..do ..	..do ..	..do ..	Do.
Tuesday	May 9	67	61	59	84	60	60	70	60	60	Calm.	0	S.	1	Calm.	0	b. c.	b. c.	b. c.	..do ..	Ebb.	Flood.	Ebb.	Clear and very warm.
Wednesday..	May 10	70	61	60	71	61	60	68	61	60	SE.	1	Calm.	0	Calm.	0	b. c.	o. d.	o. c.	..do ..	..do ..	..do ..	..do ..	Overcast and rainy.
Thursday...	May 11	62	61	60	62	61	60	62	61	60	NE.	2-3	NE.	2	NE.	2	o. c. d.	o. c. r.	o. c. r.	..do ..	..do ..	..do ..	..do ..	Cold and rainy.

MAY 12 TO MAY 28, 1882.

Friday.....	May 12	57	59	59	58	60	60	62	61	60	NE.	1	NE.	2	NE.	2	o. c.	o. c. d.	o. r.	Clear.	Ebb.	Flood.	Ebb.	Cold and rainy.
Saturday	May 13	56	60	60	58	60	60	58	60	60	NE.	1-2	NE.	2	NE.	2	o. r.	o. r.	o. r.	..do ..	..do ..	..do ..	..do ..	Do.
Sunday.....	May 14	58	59	60	60	59	59	60	59	59	NE.	1-2	NW.	1-2	NW.	2-3	o. r.	o. r.	o. r.	..do ..	..do ..	..do ..	..do ..	Do.

Monday	May 15	64	59	59	63	58	58	62	58	58	NE.	1-2	N.	1	Calm.	0	b. c.	o. c.	o. c. r.	..do ..	Flood.	Ebb.	Flood.	Do.
Tuesday	May 16	59	58	58	64	59	59	63	58	58	NE.	1-2	N.	1-2	W.	2	o. c.	b. c.	o. c. p.	..do ..	Ebb.	..do ..	..do ..	Cool and pleasant; light showers in the afternoon.
Wednesday	May 17	64	58	59	65	60	59	65	60	59	W.	2	N.	1	NE.	2	b. c.	b. c.	b. c.	..do ..	..do ..	Flood.	Ebb.	Cool and pleasant; light showers.
Thursday	May 18	62	59	59	66	59	59	63	59	59	Calm.	0	E.	1-2	E.	1-2	b. c.	b. c.	b. c.	..do ..	High.	Ebb.	Flood.	Cloudy, cool, and pleasant.
Friday	May 19	57	59	60	57	59	60	58	59	59	NW.	1-2	N.	1	N.	1	b. c.	b. c.	b. c.	..do ..	Ebb.	Flood.	..do ..	Clear and pleasant.
Saturday	May 20	61	60	63	74	65	60	73	62	67	NE.	1-2	Calm.	0	E.	2-3	b. c.	b. c.	b. c.	..do ..	..do ..	Ebb.	..do ..	Partially cloudy; warm and pleasant.
Sunday	May 21	70	64	64	78	64	64	70	62	64	NE.	1	Calm.	0	Calm.	0	b. c.	b. c.	b. c.	..do ..	..do ..	Flood.	..do ..	Cloudy and warm.
Monday	May 22	72	63	63	74	63	70	74	63	70	Calm.	0	SW.	1-2	SW.	2-3	b. c.	b. c.	b. c.	..do ..	Flood.	..do ..	Ebb.	Cloudy; passing showers; raining heavily at night.
Tuesday	May 23	66	64	68	72	62	62	70	62	62	Calm.	0	W.SW	2	SW.	1	b. c.	b. c.	b. c.	..do ..	..do ..	..do ..	..do ..	Warm and pleasant.
Wednesday	May 24	72	64	68	76	65	70	72	65	70	SW.	2	SW.	2	SW.	2	b. c.	b. c.	b. c.	..do ..	..do ..	..do ..	..do ..	Do.
Thursday	May 25	72	64	68	75	65	70	74	65	70	W.	2	W.	2	W.SW	2	b. c.	b. c.	b. c.	..do ..	..do ..	..do ..	..do ..	Cloudy; clearing towards sunset.
Friday	May 26	70	65	68	76	65	68	70	65	68	SW.	1-2	SW.	1-2	W.	2	b. c.	b. c.	b. c.	..do ..	..do ..	..do ..	..do ..	Clear, warm, and pleasant.
Saturday	May 27	74	65	68	82	65	70	70	65	68	SW.	2	SW.	1	W.	2	b. c.	b. c.	b. c.	..do ..	..do ..	..do ..	..do ..	Do.
Sunday	May 28	74	65	69	83	67	72	74	67	72	SW.	2-3	SW.	3-4	SW.	2-5	b. c.	b. c.	b. c. q. r.	..do ..	Ebb.	..do ..	..do ..	Partially clear; heavy rain squalls at 5.30 p. m.

MAY 29 TO JUNE 8, 1882.

Monday	May 29	75	65	71	80	67	72	75	67	72	NE.	1	NE.	1	NE.	1	b. c.	b. c.	b. c.	Clear.	Ebb.	Flood.	Ebb.	Clear and pleasant.
Tuesday	May 30	75	67	72	78	67	72	78	67	72	SW.	2	SW.	2-3	SW.	2-3	b. c.	b. c.	b. c.	..do ..	..do ..	..do ..	..do ..	Clear, warm, and pleasant.
Wednesday	May 31	77	68	72	82	68	73	78	69	72	SW.	3	S. SW.	3-4	S.	2-3	b. c.	b. c.	o. c. r.	..do ..	..do ..	..do ..	..do ..	Clear and warm; raining last hour; strong breeze from S. SW.
Thursday	June 1	74	69	73	80	69	72	80	69	72	S.	3	W.	2	W.	1-2	o. r.	b. c.	b. c.	..do ..	..do ..	..do ..	..do ..	Raining in the morning; clear, warm, and pleasant rest of day.
Friday	June 2	74	69	72	74	69	72	70	69	72	NW.	1	NW.	1	E.	1	b. c.	b. c.	b. c.	..do ..	Flood.	..do ..	..do ..	Clear and pleasant.
Saturday	June 3	70	70	72	81	70	73	80	70	73	S.	2	SW.	2-3	E.	1-2	o. c.	b. c.	b. c.	..do ..	..do ..	Ebb.	Flood.	Partially clear, warm, and pleasant.
Sunday	June 4	77	70	74	77	70	74	72	70	73	NW.	2	NW.	2	NW.	2	b. c.	b. c.	b. c.	..do ..	..do ..	..do ..	..do ..	Clear and pleasant.
Monday	June 5	72	70	72	72	70	70	68	70	73	W.	2	W.	2-4	W.	1-2	b. c.	b. c.	b. c.	..do ..	..do ..	..do ..	..do ..	Cloudy and cool; light to fresh breeze from the westward.
Tuesday	June 6	74	70	71	76	70	71	68	70	71	NW.	2	NW.	2	NW.	0-1	b. c.	b. c.	b. c.	..do ..	..do ..	..do ..	..do ..	Clear and pleasant.
Wednesday	June 7	74	70	72	85	70	72	75	70	72	S.	2	S.	1	S.	2	b. c.	b. c.	b. c.	..do ..	Ebb.	Flood.	..do ..	Do.
Thursday	June 8	79	71	73	84	71	73	73	71	74	S.	1	S.	1	SW.	1	b. c.	b. c.	b. c.	..do ..	..do ..	..do ..	..do ..	Do.

The hours of observation were 7 a. m., noon, and 9 p. m. daily.

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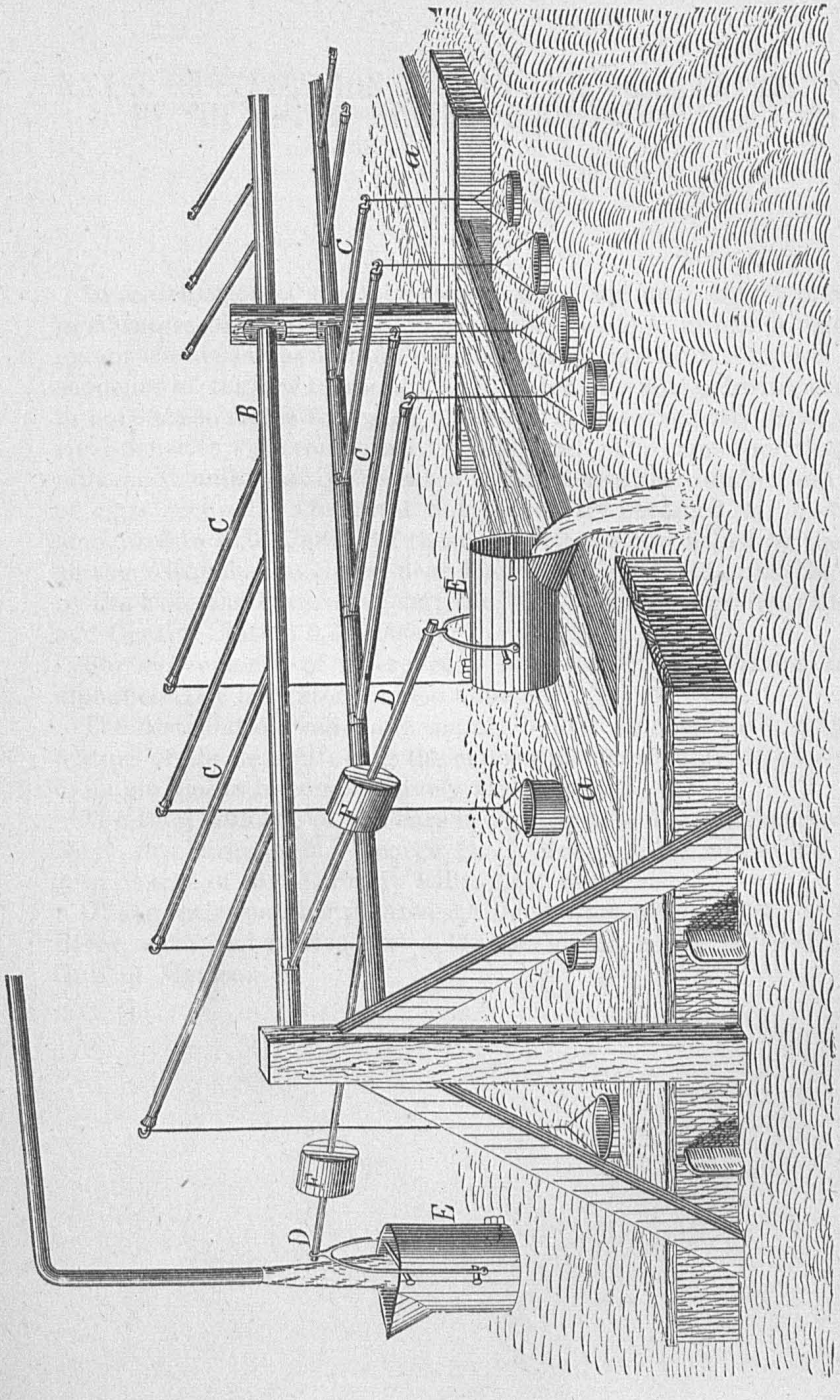

Apparatus for operating shad-hatching cylinders.