

Question #63: EH experience with Q-clearance

We now start on Reel 5. I think that everything is in order now so that this will be a good record. The way you got your Q-clearance reminds me of the way that I got mine. I've had every kind of clearance there is, I guess, and I never filled out a questionnaire, and I never made application for a clearance at any time.

[X-REF FORWARD TO P. 689] When any of this business came up, I always said that I was given my original clearance by the President of the United States, and that I didn't intend to have some subordinate officer check up on his decision. FDR did give me clearance when he issued the executive order establishing OSRD, because in that order, although I don't remember the exact wording, [SEE APPENDICES, SCIENTISTS AGAINST TIME] he said that as director I was entitled to such secret information from the Army and Navy as would be necessary for the performance of my duties. So I never asked for a clearance.

I had several episodes on this; one was quite rich. After the war, the Atomic Energy Commission called me in on something, and we had lunch. They started to ask me some questions, and I asked them one or two. When they didn't come up with answers,

- 1) GETTING CLEARANCE
- 2) ORIGINAL CLEARANCE
- 3) POST WWII
- 4) THE AEC

I made the questions much more pointed. The really tough piece of secret information at that time was on the stock of bombs. I asked them that, and of course they ducked the question. So I said, "Apparently you gentlemen are giving me some sort of a partial clearance. I don't work under those circumstances. Let's talk about something else." They'd ask a question, and I'd say, "Yes, I think it's going to rain tomorrow." We broke up the conference without getting at the subject matter in any way whatever. [X-REF FORWARD TO P.690]

- 1) POST WWII
- 2) CLEARANCE (Cont'd.)
- 3) AEC

I paid no more attention to it, and forgot all about it. I didn't hear any more from them. Some time later, some chap consulted me on an atomic energy matter. When he started in he said, "Of course you have a Q-clearance," and I said, "Why I don't know, have I?," and he said, "You certainly have." So in some way or other, a Q-clearance was issued to me, by vote of the Commission, apparently, without telling me anything about it.

I had other times -- I remember they [EH to VB: WHO? THE AEC?] [VB to EH: AN AIR FORCE MEETING AT MIT] had a meeting somewhere not long after that (and remember that among other things I'd been chairman of the Research

and Development Board for the Department of Defense) and some Air Force colonel called me up and asked me if I'd attend the meeting. I said, "Yes, I'd be glad to come," and he said, "Well, you'll have to have a special clearance for this meeting." I said, "That's too bad, I'm not coming." That ended the phone conversation. He called me up again in an hour or two, and he said, "I find that you have every clearance necessary." I said, "All right, I'll be at your meeting." I think, in addition to saving myself a lot of trouble, the fact that I've taken that attitude right along has helped a little bit to ease things elsewhere. I hope so at least.

- 1) CLEARANCE
- 2) OSRD

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During the war, in OSRD, we handled our own clearances, and we did it very informally. [X-REF FORWARD TO P. 687] I was given access, somewhat grudgingly and not completely, to Army and Navy intelligence when some individual came up. They occasionally made recommendations to me, but we had the final decision, or I did, on the clearance of any individual. The most that we did was this: if we were going to set up a new section, the man on

NDRC who was concerned, for example Dr. Compton, would pick somebody to head that section, and naturally he'd pick someone in whom he had entire confidence. This constituted the man's clearance. When the man who was chosen to head the section went to make up his section, he did the same thing, and with the approval of Compton, they were then appointed. There wasn't any questionnaire business, or snooping around the corners.

1) OSRD & CLEARANCE

In the entire history of OSRD, we did not have one case of disloyalty among OSRD personnel, and I don't think we had one among our contractors. [X-REF BACK TO P. 218 AND FORWARD TO 687] We had only one case of carelessness that I remember. A good friend of mine, who was Dean of Science at MIT later, left a briefcase on a train. I proceeded to chew him out on that. But I think that was our only "incident".

You and I have one thing in common, namely that Harry Truman got mad at each one of us, and apparently recovered from it afterwards in each case, or at least didn't connect two parts of the same story together.

A lot of the yarns that go around about clearance and safety and so forth are, of course, utterly foolish. I've been visited I suppose a hundred times by chaps making clearance interviews in regard to people that were being given appointments. Usually the chap that comes around for this purpose is merely going through some motions. He doesn't really get at facts, and he wouldn't get at facts if there were any there. When one of these chaps comes to see me, he shows me his card showing that he's an investigator for somebody, and proceeds to ask me questions. He'll soon ask me a question which shows he hasn't the ghost of an idea who he's talking to, or what my background is, whereupon I ask him a question or two, which shows that he's taken no trouble at all to look me up in Who's Who or elsewhere before coming to waste my time with his doggoned interview. When he gets to that point, I throw him out, and tell him when he's studied his lesson I'll see him again. Of course I never do see him again; some other guy comes to see me. But the fellow who comes the second time is likely to know what he's talking about, at least to the extent of knowing who the man is that he's talking to.

- 1) CLEARANCE
- 2) HANDLING INVESTIGATIONS

We're really a bunch of nuts in this country; the Soviets don't really need a spy system to find out nearly all they need to know about us. If they merely took our engineering and technical magazines and studied the advertisements, they'd get pretty nearly all they'd need to know. [X-REF AHEAD TO P.329] That plus looking over the hearings in Congress and a few other things that are quite public, would give them what they want. I've just read The Spy Who Came In From The Cold and it gives me a pain in the neck. Spy systems don't operate the way that book, and most books, paint them. We don't have that kind of cloak-and-dagger stuff to find out the things that from that book they were trying to find out. Oh, we have cloak-and-dagger stuff, all right, but it's not connected with the assemblage of the data that we want to know about Russia, or they want to know about us. The fact that the public falls for it doesn't bother me too much, but I think it does put some strange ideas in the minds of kids.

[ EH to VB: Q: ASK VB ABOUT 1) Klaus Fuchs  
2) Allen Nunn My 3) The Rosenbergs 4) Our  
slowness at translating the mass of Russian scientific literature to which we've had free access.]

[VB to EH: I'm writing here, of course, on technical matters, and on peacetime espionage. A spy system, as popularly pictured, does not get at the

- 1) EASY ACCESS TO INFORMATION
- 2) OUR "SPY SYSTEM"
- 3) "THE SPY WHO CAME IN FROM THE COLD"

technical details of new weapons. Much comes from the literature. Defectors carry over full details in the area in which they are operating. But the idea that some sleuth can copy a formula somewhere which gives away the works is nonsense.

1) ESPIONAGE IN  
WAR AND PEACE

[During the war, Groves had a counterespionage system of his own. Through this he knew of channels to Russia, and these were not forcibly broken up, although some were isolated by transfers, etc. I don't think Groves tells of this. There were, I feel sure, channels to Russia through French scientists. We went slowly in collaborating with the French for that reason. In one way or another, I feel sure Russia learned all it needed. Henry Smyth knows about this in detail, since he used the knowledge in writing his book.

[In peacetime there are other areas than the scientific. Here, corrupting a clerk or the like may work. For example, what missiles are trained on what targets.

[In general I feel the usefulness of peacetime espionage is overrated. When there is acute danger of war, it becomes important in regard to troop movements, etc. In peace about everything needed can be learned without it.] [END WRITTEN COMMENT]

(Speaking of the influence of books of that sort, [P. 279] this is way off the beaten path, but I was looking over last night a mystery story, one of the Ellery Queen things, and it was all about a strangler who strangled seven or eight people. This was published, I think, as a paperback in '59. I've wondered whether some psychotic individual read that thing, and it suggested to him the series of stranglings that they've had in New England. There's enough similarity to make one wonder.

(I read detective stories, and I like to do so, but I like to read the kind that are full of close reasoning on evidence and so forth; that amuses me. These that try to put in a horror story don't amuse me at all and I suspect they don't do a great deal of good. I put this in in case you and I ever started to write a mystery story together.)

1) THE INFLUENCE OF  
MYSTERY STORIES

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Question 64: Government in Education

Every time someone talks to me about the danger of Federal Government control of our presently private universities, of coercion, of telling the faculty exactly what to do and so on, I always reply by saying that not even a first-rate bureaucrat, backed up by a lot of funds, could ever manage a college faculty. The college faculties are among the few people in the world that take orders from nobody. They don't take orders from their dean, or the president of the university. The only thing that they follow is public opinion among their colleagues. This has real influence; it is very seldom indeed that a faculty member defies it.

[X-REF TO P. 661]

I have been quite happy about the way we've handled our use of public funds in this country for research and for the support of education. I don't think we've supported the medical schools to the extent we should have. There is a great shortage of doctors in the country and it's going to get worse. The cost of a medical education is so high that it makes an unnatural selection of students

- 1) FEDERAL CONTROL OF UNIVERSITIES
- 2) INDEPENDENCE OF COLLEGE FACULTIES
- 3) PUBLIC FUNDS AND EDUCATION
- 4) NEED FOR SUPPORT OF MEDICAL SCHOOLS

because of the costs. One of my sons is a surgeon. I can't cast up exactly what it cost me to put him through medical school and internship and residency and special stuff and so on -- plus his four years at Amherst -- but I suppose it was \$50,000 or something like that. This is a huge barrier to a great many people. They can't borrow that much money to go through medical school.

After he gets out and into practice, the young medical man earns altogether too little money for quite a long time. It's a relic of the old guild and apprenticeship systems. Then of course, after he finally gets established, in some cases he earns too doggoned much money.

I object to some of the forms of medical education very strenuously. For one thing, I don't like the system whereby a man takes a liberal arts course in college and then goes into four years of medical school where liberal arts subjects are never again mentioned. The student is then completely unbalanced in his outlook when he gets through, [X-REF AHEAD TO P. 312] unless he is one of these individuals who will see to it that he studies what he wants to study in spite of the system in which he's involved.

Coming back to the support of medical schools: our medical schools are doing better than they used to;

- 1) IMBALANCE IN MEDICAL EDUCATION
- 2) NEED FOR SUPPORT OF MEDICAL SCHOOLS

they are helped a good deal by research grants. But most of the class A medical schools are still going in the red, and living off their fat, or else they're living off the rest of the university with which they're associated, and this isn't good. When the Ford Foundation was first formed, they set up a committee to try to map out a plan for the Foundation. It finally published the plan, and I didn't think much of it. Now when this was going on, I wrote to Paul Hoffman, with Karl Compton's backing on it, and suggested to him that one of the best things the Ford Foundation could possibly do as it started in, would be to bail out the class A medical schools. It would get good public acclaim; it would get the Foundation off to a good start; it would also accomplish some very practical things for the American public, and it would be the only way in which the medical schools could be saved from complete public support in the long run.

I didn't get to first base. Hoffman and the rest of the crowd had their heads in the clouds; they were going to save America in various ways, and I didn't get anywhere, which was too bad.

I also suggested at that time (as I've suggested in various other places at other times) that the best way to subsidize the medical schools would be to subsidize men getting out of high school or college, one or the other, headed for medicine. They would get the right to

- 1) NEED FOR SUPPORT OF MEDICAL SCHOOLS
- 2) FORD FOUNDATION & HOFFMAN

a fellowship, or scholarship, by some competitive or selective scheme and would then be given the right to pick their own medical school; whereupon, not only would their tuition be paid, but a really generous grant would be made to the school to cover the added costs beyond the tuition. I think this would be very salutary; it would create something we very much need, and that is competition among medical schools. There's plenty of competition among universities today for the best students -- best not merely from the standpoint of grades and the college entrance examinations, but best from the standpoint of interviews and judgment of promise and so on. We don't have that in medical schools, and I wish we did.

I'm left a little cold by the great argument that within a few years we've got to train several times as many college graduates as we're now training. I don't get excited about it because I feel quite sure that there are a very large number of people going to college today who never should have. One of the saddest things in the world is to see a chap who's been brought up to believe that he has a great post somewhere waiting for him -- that with merely a little hard work once in a while, he's bound to become president of some corporation or something, or at the very least he's going to be a college graduate and lead a highly cultured life -- and

- 1) NEED FOR COMPETITION  
AMONG MEDICAL SCHOOLS
- 2) COLLEGE DOES NOT  
BENEFIT MANY

then see that chap end up selling shoes or leaning over a drawing table. This is pretty tough. The number of times it occurs I don't know, but I have the general feeling that it occurs much more than we wish it did.

1) COLLEGE EDUCATION

[EH to VB: This is a great page, but I think it makes obligatory that you present the VB Differential Plan whereby we cease promising to all youth that of course they can go to college and should. Today we have an undergraduate population of  $\pm$  4.7 million, and  $\pm$  25,000 "teachers". We're already under conditions of overload. What do we do? Downgrade the bachelor's degree a la Bob Hutchins? Or what? Your P. 285 following merely lets these questions fade out. What do we do with the mess so that we can give the superior boy or girl what he/she deserves? Would you not be for a better system of industrially aided vocational schools, leading to certificates of competence, let's say -- but complete divorcement between this and our university system, and colleges of liberal arts, so called? But, once again, what selective system would decide who went where? I think this is an inescapable topic for BBS if not for BBJ.]

[VB to EH: The problem resides in the attitude of the American people. Let's try a new approach for a moment.

[Why do we educate? For two reasons. First, the practical one: so that the man educated may contribute to the public welfare to the best of his ability, and, in the process of doing so earn a good standard of living. Second, so that he may find pleasure and satisfaction as he does so.

1) PURPOSES OF  
EDUCATION

[The respect bestowed by the public should be in accordance with how well these criteria are met. Influence in the community, leadership in this sense, should follow this respect.

[But note that we have now defined as a success the man who becomes a skilled toolmaker. His manual skills will far exceed those of his dentist. The knowledge he accumulates, and on the basis of which he directs his assistants may be intricate and extrinsic, more so perhaps than those used by the president of the local savings bank. Moreover he may be a cultured man, in the sense that he has learned to enjoy life and to convey to his fellows appreciations which make enjoyment possible. I grant the combination may be rare, but I think it is equally rare among bank presidents.

[This culture will in all probability not include early English literature, or any other subject which has been artificially elevated into an accepted category. It might be just an appreciation of some of the beauties

of nature, which he can find deeply and aesthetically appealing, but which procedure does not usually elevate unless it appears in one who has first demonstrated his culture by means derived from books.

1) EDUCATION:  
CULTURE & SUCCESS

[Much of the unbalance of our educational system comes from distorted ambition, not necessarily on the part of youth, often only on the part of parents.

[It derives of course from the age-old system of classes, and the barriers to transfer between classes. This we have by no means overcome, but we have approached this more closely than any other nation in history.

[Hence we aim to educate far more of our youth for positions in an upper class than can ever arrive there: a class that leads, is affluent, has leisure -- and has culture in the way in which we have long artificially defined it.

[I fear we will not escape this for a long time. Meanwhile we will educate many who will be frustrated and unhappy, who cannot succeed in the so-called higher levels, and who cannot find a nook in the area where they really belong.

[This calls for a new type of school, at high school level, followed by a partial equivalent of college conducted by large industry for its employees. A primary point regarding it is that it must embody provisions such that the unusual and gifted chap will find opportunity to rise in the organization just as fully as the chap who

comes in from the conventional college] [END WRITTEN COMMENT]

Britain has done a great job on support of their universities. Parliament makes funds available, and a committee allocates it among their universities. I don't think we could get away with that in this country; I think in this country that would be hot stuff. However, in this country I think we've done pretty well. Most of our subsidy has been through two channels; first, subsidy on research, about which I've spoken, and where the system of skilled committees operates pretty well; and second, subsidy of students, and for example, the National Foundation fellowships and so on. This has the feature that I've called for many times, namely the opportunity for the youngster to pick his own university. We get at MIT every little while a summary of where these chaps go. If a very large number of them were not picking MIT, we'd know perfectly well that something was the matter with us, that we were slipping. They do, of course, but I think it's great stuff to have universities subject to the scrutiny and judgment of a bunch of very capable youngsters. [EH to VB: BINGO!]

I'm dictating this just before the Republican Convention, but I can give you my opinion of what's going to happen in November. My opinion is that in November the Republican party is going to get itself into a mess from which it won't recover for many years.

- 1) BRITISH VS AMERICAN  
SUBSIDY OF UNIVERSITIES
- 2) AMERICAN UNIVERSITIES  
& THE SCRUTINY OF  
YOUNGSTERS

Question 65: Research & Development Contributions  
by Corporations to Universities

I don't think there's any difficulty today in corporations about the deduction of research and development expenditure as a part of current charges against income before taxes. Also I think the A. P. Smith case, which you quote, has clarified the situation sufficiently in regard to gifts to education by corporations so that there's no longer any argument on that. No stockholders' suit would stand much chance there. But the problem of how a corporation gives away its money, is a really tough one. How does it pick what colleges and universities to support? Well, there's one way of doing it that I think is not too bad: in the Merck Company for example, we had two systems. First, if one member of the staff made a gift to his own university, we would match it. [EH to EH: MATCHING FUNDS IDEA NOW VERY WIDESPREAD. Cf TIME INC & CBS IDEAS, ETC.] Second, on subsidy of medical research, we put it in the form of a loan system for interns, and we selected the medical schools as the ones that Merck and Company, or George Merck personally, had had relations with. This gave us a short list of medical schools to start out with, and we couldn't have covered all the class A medical schools. It gave us enough to start the thing, and the scheme

- 1) CORPORATIONS AND UNIVERSITIES
- 2) A. P. SMITH CASE
- 3) THE MERCK METHOD

could have been broadened later. [EH to VB: WHAT IS THE STATE OF THE SCHEME TODAY?] [VB to EH: IT HAS BEEN BROADENED I BELIEVE] It wasn't a bad idea, because usually the interns need a loan pretty badly, and to get one at very low interest and so on was a help. We did another thing: we did not put the loan funds in the hands of hospitals where the interns were working. These hospitals already have all of the hooks they ought to have on the interns, and more. We put the loan fund in the hands of the Dean of the medical school from which the boy had graduated. I think it was a good idea, and I think it's worthwhile. I believe it's been copied quite a lot since then.

There have been some attempts to set up a central affair, society or something, a foundation, into which corporations could pay money and which in turn would distribute them to universities. It's never been very successful. Wilson Compton, Karl's brother, headed this thing for a while; I don't think it ever really got off the ground. The trouble is that a corporation needs to solve its own problems; in order to solve the problem of where it will place money for education, it needs to make its own formula. It can, if it pleases, simply take a poll, take a census, of its own professional staff, both in business and in science and engineering etc. to find out where

- 1) CORPORATIONS & UNIVERSITIES (Contd.)
- 2) THE MERCK METHOD

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Page 287 A

who graduated, and weight it if they please by the rate of progress of the men since they've joined the organization; in this way it can get a list of universities with weights attached thereto. If the corporation gives to universities proportionately to those weights, it can hardly come under criticism, particularly because it can say to the stockholders that they're supporting a necessary source of manpower. The only difficulty with the scheme is of course that universities change, and this takes no account of it. Just how to do that, I'm not sure.

1) CORPORATIONS AND  
UNIVERSITIES

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Question 66: Patents. The Patent System.  
Abuses and Applications.

I'm certainly not going to dictate an article on the patent system, which would fill a book in itself, but I can make a few comments. The story about the Wright Brothers as you have it is not quite right, and it's quite an interesting story when you get it. The Wrights, of course, could not get a patent on the Art of Flying. Patents are not issued on the basis of an art or an idea; patents are issued on a new and useful combination. That's all that can be patented. If they tried to get a patent on the idea of flying, well, Leonardo da Vinci would be a reference against them.

What happened was this: there was a struggle between the Wright Brothers and Glenn H. Curtis, and interference. In the course of that interference, the Curtis people tried to show that the work done by Langley of the Smithsonian, anteceded the Wrights. You see, the Wright patent primarily was on warping the wings to maintain level flight. The warping of the wings was succeeded by ailerons, a different means to the same end: i.e., separate flaps were tipped rather than the entire wing being warped. This was the main thing which was in interference.

- 1) THE PATENT SYSTEM
- 2) THE STRUGGLE BETWEEN  
THE WRIGHT BROTHERS  
AND CURTIS

Langley built the machine, you remember, which he tried to fly over the Potomac, and which went a little way and dumped into the water. Now that Langley machine was in the Smithsonian, [EH to VB: YOU DON'T NAME THE SECRETARY OF THE SMITHSONIAN. WAS IT C.G. ABBOT IN THOSE DAYS?] [VB to EH: NO, WALCOTT, I BELIEVE.] and the Smithsonian loaned it to Curtis, something they never should have done: loaning a Smithsonian exhibit to a contestant in the suit. The Wrights also claimed [EH to VB: I MADE 'Wright' INTO THE 'Wright Brothers' BECAUSE WILBUR DIDN'T DIE UNTIL 1912.] that before Curtis flew this machine, he altered it from Langley's original form. Whether he did or not, the Wrights were very irritated, and quite properly so, at the Smithsonian for getting into one side of a controversy of that sort. Well, it was for this reason that the Wrights took their original machine over to England instead of leaving it here in this country as an exhibit.

Now there's more to this story. When I was chairman of the National Advisory Committee for Aeronautics, Wright and the secretary of the Smithsonian [VB to EH: ABBOTT AT THIS TIME] were both members. Quite naturally they didn't have much to say to each other. One day we were having some sort of a celebration and a reporter I knew came to me and said he wanted to get a photograph of Wright and the secretary together. And I said,

- 1) THE PATENT SYSTEM
- 2) THE WRIGHT-CURTIS CONTROVERSY
- 3) FLASHBACK TO NACA

"You've got the chance of a snowball in Hades, but I'll do what I can for you; just be sure that your photographer is not conspicuous; by no means let him look in my direction, and I'll see what can be accomplished. I'd like to bring them together myself." So I sat down with the secretary; I was looking over a model of an airplane with him, and Wright went walking past our chairs. I turned and said, "Oh, Wright, here's a thing that will interest you," and he, before he thought of it, leaned over, and the photographer shot his picture. I don't think either of them knew it was a result of conspiracy. I may have got this wrong on one thing; I'm not sure whether I sat down with the secretary or with Wright, but that's substantially the way it happened.

Now this secretary began to do all sorts of things later on in the Smithsonian which he had no right to do without consulting his regents, and some of these were quite trying. But he did one thing that I applauded, even though it was quite out of line. He finally published a paper -- he did this without consulting anybody that I know of -- in which he said flatly that in his opinion, the Smithsonian Institution had behaved entirely improperly in the Wright-Curtis interference. On the basis of the publication of this, Wright allowed his machine to be brought back to this country. We might note in passing that the British

- 1) THE PHOTO OF WRIGHT & SECRETARY OF THE SMITHSONIAN
- 2) THE WRIGHT-CURTIS CONTROVERSY (Contd.)

were pretty generous too in allowing it to come back.  
It's now in this country and on exhibit.

You ask what kind of background I have for the statement that there have been abuses in the use of patents. At one time -- well, twice, I think, I was a member of a committee, a commission or something set up by the president to recommend modernization of the patent system, and we got nowhere. In one of these cases one member of the committee was Kettering. I knew he wouldn't do any work. Another member was a lawyer in New York who I knew would oppose any change whatever. So I wrote out a document in which I gave my own personal recommendations for the modernization of the system. [X-REF AHEAD TO P. 498] Of course this was just a confidential document among the committee, or at least it was not published. Quite a long time later, when the Senate was looking over the patent system, O'Mahoney, I believe it was, asked me to come and testify, and I told him, "From what I hear you're going to have a lot of crack inventors before you, and I'm not going to join you." He said, "Well, will you write us something on it?", and I said, "Sure I'll write you something." So I took out that old document with recommendations for the improvement of the patent system, and sent it to the Senate, and they published it. [EH to AB:  
WE SHOULD OBTAIN]

- 1) ABUSES IN THE PATENT SYSTEM
- 2) O'MAHONEY'S COMMITTEE
- 3) BUSH'S DOCUMENT

I got some quite interesting reactions about it. I thought the patent attorneys would all be mad at me, but they weren't. In fact the patent bar in New Jersey gave me a medal not very long after. It was made out of bronze, I believe, and it was about 3/4 of an inch in diameter, but it was a medal anyway. So they didn't take great umbrage.

What did I put in that document? Well, for one thing, I took the case of the United Shoe Machinery Company and pointed out that that company had gotten such a monopoly on patents on shoe machinery that when somebody made an invention along that line, he only had one customer to go to; he couldn't possibly sell his patent to anybody else. Hence the United Shoe could buy it at its own figure. [X-REF AHEAD TO P. 600] One of my recommendations was that after basic patents had been made to such an extent that they dominated a certain section of industry; all improvement patents thereafter should be made subject to license at reasonable royalties, to keep the perpetuation of a patent monopoly from taking place. I haven't given you the exact wording.

Incidentally, when I was discussing this thing with the Committee, Mr. Folke [EH to VB: PLEASE VERIFY NAME] [VB to EH: WHO'S WHO OF ABOUT 1935 WOULD SHOW. I THINK IT WAS FOLKE], who had been the patent attorney

- 1) ABUSES IN THE PATENT SYSTEM
- 2) BUSH'S DOCUMENT
- 3) THE CASE OF UNITED SHOE MACHINERY CO.
- 4) FOLKE

of the AT&T -- he was quite a well-rounded individual -- came to see me. He had retired, and was working for the NAM, and he came down to protest about all these changes. I took this particular point up with him and the reason for it, and so on. I used the illustration of the United Shoe Machinery Company, and every time I did so, he'd say, "I wish you'd take some other illustration." Well, when we got through with that conference, he said, "I can't give you any statement representing my clients on this; they'd probably continue to feel just as they did right along. But," he said, "I can tell you personally, and entirely personally, that I think you're right."

The trouble is that the patent system has never changed. The only people who really know anything about the system are the patent attorneys, the patent bar, and the companies that use patents extensively. They certainly don't come whooping in and demanding changes. They're much more likely to dig their heels in the sand. Hence the system is not in accord with modern practice. It isn't bad, but it's not nearly what it might be if it were revised. The only revisions have been very minor indeed.

- 1) ABUSES IN THE PATENT SYSTEM (Cont'd.)
- 2) FOLKE

Of course what's been happening in recent years -- oh, in the last 20 years -- is that the patent system has come close to being destroyed by the courts. For apparently judges on the bench have gotten the idea somewhere that if they destroy a patent, they are doing something for the American public. I don't know how they get that idea, although it's true that general counsel very seldom understands the objectives of the patent system.

I had a good illustration of this once. MIT had serious difficulty, when I first went in as vice-president, because various companies were retaining professors as consultants. The professors would make inventions, and the inventions would be taken over by the supporting company, even though a large part of the expense of the research was carried as overhead at least by the Institute. We needed to stop that racket, and we also needed to give some assurance to men who behaved properly in regard to patents in the Institute that they had our full backing. I worked up a patent policy, and the faculty approved it. We put it before the Corporation, and it was there opposed vigorously [X-REF AHEAD TO P. 661] by Gerard Swope. The Corporation referred it to Elihu Root -- Elihu Root Senior, of course, for his opinion. I went down to New York to see Root. He immediately took the point of view that a public institution such as MIT should do nothing with

- 1) JUDGES DESTROYING PATENTS
- 2) MIT's PATENT POLICY
- 3) GERARD SWOPE & ELIHU ROOT, SR.

inventions within its walls, except to dedicate the patents to the public. I said to Root, "By what right does an institution such as MIT destroy a piece of property created by the United States Government under the statutes?" After a considerable pause he said, "You know, I never thought of it that way before." He knew perfectly well that a patent was property, of course. Well, we had quite a conversation, and he ended up by endorsing the patent policy, the Corporation adopted it, and it's been working well ever since. It's recently been revised, but not to much of an extent, and recently MIT collected quite a large amount of money, a good many million dollars out of royalties on one of the inventions. The point I'm making is this: here was Elihu Root, a very competent general counsel, who did not understand the objective of the patent system. But that's enough about the patent system.

I'd add that in long experience with the system I've never seen any situation when I suspected corrupt practice on the part of a patent examiner.

- 1) MIT PATENT POLICY
- 2) ELIHU ROOT, SR.

Question 67: Rapid Flow of Technical Information and  
its Translation...American Technical  
Capabilities...Gas Turbine

This is Q. 67. Now it's no doubt true that after the war we paid very little attention to the Russian scientific literature. On the other hand, there are two things to be remembered here. One is that after the war, and for some time, Russian science didn't really get going. As I've mentioned elsewhere, I think that the turn came when Russia realized what it was up against, took the commissars out of the laboratories, and began to give the scientists their head. [X-REF BACK TO P. 225] Remember there was a time when Russian biologists, for example, were completely bound to proceed on the theory that there were inherited acquired characteristics, and that may not be all over yet. It was true in every other part of science; that there were dogmas, and the scientists were tied down. They got their freedom later.

The second point to be remembered is this: there is now so much scientific literature appearing in the world that no man can possibly follow it, even in the specialty that he's concerned in. This means, of course, that specialties are getting more and more fragmented as people begin to pay attention to narrower and narrower subjects. They're almost forced to do so,

- 1) POST WWII
- 2) RUSSIAN SCIENCE
- 3) MASS OF SCIENTIFIC LITERATURE

because the literature is so comprehensive that if they tried to spread out at all, they'd spend all their time reading and none of their time doing research. We have that problem; we have it without Russia. We will have it until we finally learn how to handle our scientific literature so that one can get at the things he needs quickly, without poring through a lot of useless material.

1) HANDLING THE MASS OF  
SCIENTIFIC LITERATURE

There's a lot of work going on on this. There's a little group in Washington that's trying to get a lot of federal money to make a central scientific library that will hold everything, and that can then pass it out to other libraries and so on. This wouldn't help much. It wouldn't help much because the libraries everywhere don't know what to do with what they've got. I can't give you the figures offhand, but there are tons and tons of scientific literature coming out every month.

Between the wars certainly we were smug. [X-REF AHEAD TO 779-780] We were smug more about our applied technology than we were about our fundamental science. I think a great many scientists in this country for that matter looked on the Braggs, and Bohr and Planck and so on as very remarkable people, but not carrying on the kind of things that they had to know in order to progress in their science. We had some people in this

country of course that were fully abreast, but there isn't the slightest doubt that on basic science, between the wars, we were children. We were getting nowhere in comparison with Europe. We were smug because we were making all sorts of practical applications, and that's the thing the American people goes wild about, so that we got quite up on our ears as far as the rest of the world was concerned. We were the people who could make the gadgets.

Now, when it comes to specific things, I'll have to have quite a lot to say later no doubt about the origins of radar. In particular I'll have to say something about what the British brought to us when we finally had interchange, and the story of how that interchange came about is an excellent one. [X-REF FORWARD TO 425, 701, 702] We also want to say something somewhere in this record about the origins of penicillin, which can be summed up quite fairly easily.

When we come to practical things, such as the combustion turbine and the jet engine, I can testify personally on this that we are not forward-looking in our technical developments along the lines of engines, and we haven't been. The primary reason for this is that the development of engines today is principally in the hands of the great automobile companies because they are the ones who could best afford to develop a

- 1) AMERICANS AND APPLIED SCIENCE
- 2) ENGINES AND THE AUTO-MOBILE COMPANIES

new engine. [However this does not apply to aircraft engines, which is on a different subject.] The sad thing is [X-REF FORWARD TO PP. 304, 497, 498] that the great automobile companies are not at all interested in developing new engines. They're doing very well with what they've got. If they built a new engine, it would cost them many millions of dollars to change over, and after they'd done that, they wouldn't sell their cars any better than they do now.

I have an example of that personally. Some years ago I invented a new form of external combustion engine. This is the so-called hot-air engine of the old days. [X-REF FORWARD TO P. 497] I tried to modernize this. When the hot-air engine was first built, the efficiency was excellent. A chap by the name of Sterling, way back in 1825, I believe -- he was a British clergyman -- invented the regenerator on the hot-air engine, and this gave it excellent efficiency. The efficiency's good compared with the present-day diesels. Yet the hot-air engine did not come into great use because its output per pound and per cubic foot was very small. It was used all over the country to pump water, for it was a very handy gadget -- you simply built a fire under it and gave it a turn, and it would keep going and pumping till the fire went out. Ericson, who got famous for some reason I never found out, went

- 1) ENGINES AND THE  
AUTOMOBILE COMPANIES
- 2) THE HOT AIR ENGINE  
STERLING - 1825  
ERICSON

to work to improve the external combustion engine, and succeeded in making it quite a lot worse.

I had the idea back in the 30's that, with modern methods and modern gases and so on, one could make a hot-air engine really comparable to the internal combustion engine; that it would have efficiencies fully as good, that its output per pound or per cubic foot could be made as high, and that once it was made, it would practically never wear out, because of its inherent construction. I was going to do this by using metals that would hold their strength at red heat, and we'd have red-hot input instead of a warm input on a cast-iron cylinder. Then I'd have helium at high pressure as the working gas, instead of air at ordinary pressure. Taking this and one or two other things together and some other improvements, I was pretty sure I could build such an engine that would be really good.

Well, I didn't get anywhere; I filed some patents and I assigned them to the Institute, and I started making some models, and then when I went to Washington, that got interrupted. A chap by the name of Dillard Ball went on with it a bit, but in all of this we got no interest whatever from anybody in the engine business.

[EH to VB: WHO IS/WAS BALL?] [VB to EH: I'm stuck, I don't know.] Now the fact that the thing was not such

- 1) 1930's
- 2) BUSH'S HOT AIR ENGINE
- 3) DILLARD BALL

a bad idea is shown because, many years later, when I think the patents had expired in fact, Phillips, in their place on the Hudson River, built such an engine, and exhibited it. [EH to VB: WHICH PHILLIPS, PLEASE. THE DUTCH CO. BY ANY CHANCE?] [VB to EH: THE AMERICAN OUTFIT] It was quite an interesting gadget, because it would work both ways. You could build a fire under it and it would operate as an engine; or you could take a motor, turn it, and one end of it would get cold and the other end would get hot. In fact one end would get cold and make ice, and the other end would get hot enough so that you could light a cigarette on it. I didn't see it, but that's what they told me. [EH to VB: WE NEED A FIRST-HAND STORY HERE.] [VB to EH: IT'S NOW DEVELOPED FOR CRYOGENIC USE, THAT IS FOR VERY OLD PURPOSES.] So the engine undoubtedly could be built, and in many ways it would be a better engine. If I think would be a better engine for an automobile. Yet, as I say, nobody got interested, Phillips abandoned the development, and I haven't heard from it since until recently.

Now that was one experience. Another one: some time before I left the Carnegie Institution, I got some new ideas on free piston engines. These are used over in Europe, in substations and so forth, in sizes up to a couple of thousand horsepower. They're very interesting gadgets. A couple of pistons oscillate in a cylinder;

- 1) BUSH'S HOT AIR ENGINE
- 2) PHILLIPS' ABANDONED PROJECT

they're not connected to cranks in any way. Between them is a diesel cycle, and on the outside they compress air to use for their own intake. The intake to the engine is then, let's say, 100 psi, at moderate temperature, and the output is at 100 psi, at very high temperature, and this output is then used to drive a turbine. Again, the efficiency is excellent. But the European engines were a bit gadgety; they had to have a linkage with gears and so forth to hold the pistons in synchronism without any mechanical connection. This reduced them to just simple slugs. These slugs, oscillating in a smooth cylinder could be made to support themselves on a film of air, so that they could operate without lubrication. I had a number of other things; in one form, instead of driving a turbine, the oscillating outfit would simply compress oil, which could then be used in an oil motor, to drive a boat or a vehicle or something of the sort.

1) FREE PISTON ENGINES

[EH to VB: The free piston concept is clear in my mind; so is a diesel cycle; so is a turbine. Where I bog down is the how of the interconnections, and also the why -- particularly how and why does Rudolf Diesel get into this act. A page of clarification is necessary.]

[VB to EH: There are two units: an oscillator or compressor, and a turbine. The former compresses air and heats it; the latter uses this hot compressed air to develop power.

1) ENGINES

[In the compressor two pistons oscillate in synchronism. A diesel cycle between them has injected fuel and develops power to cause the pistons to reciprocate. The end volumes, supplied with valves, take in atmospheric air and compress it. This air is intake to the central volume and supercharges it. There the air is further compressed before injection at time of minimum volume. The overall compression ratio may be 40:1 or more. Hence pressure and temperature go very high, which is the reason high efficiencies are attained.

[I did a number of things. The engine as used in Europe has cylinders of two diameters and compound pistons. A small diameter piston works in the diesel cycle; a large one does the compression for supercharge. I replaced this with a cylinder of uniform diameter. The compression end now absorbed the same amount of power as before, but put it out in the form of air at high pressure and low volume. Extra stages in the turbine transformed this to air at moderate pressure and large volume, suitable for the supercharge. This involved loss of efficiency, but this was recovered elsewhere.

[With simple slugs or pistons they could be made to ride on air. No piston rings, no cylinder lubrication. Present engines have trouble from both. So my form can go to higher compression ratios. Also the cylinder can be allowed to get much hotter, the limit being merely that of holding clearances as metals expand. In the usual diesel engine about 1/4 of the heat of the fuel goes into the water jacket.]

- 1) FREE PISTON ENGINES
- 2) STEWART WARNER

[Rudolph Diesel gets into the act merely because a cycle in which the oil is injected into the hot gas, and becomes thus ignited, gets called by his name.]

[END WRITTEN COMMENT]

I made a deal with Stewart Warner; they started to develop it. I made this deal by saying to them, "This is too large a project for you to handle, but on the other hand, you can make trades more easily than I can and much better. Hence I will make a contract with you under which you are not only encouraged, you're almost forced, to make a deal with some big outfit to take over most of the costs, and we'll make the deal on that basis." We did. Stewart Warner did enough experimentation to prove that some of the fundamental ideas were sound; they didn't make a full rounded engine, but they did quite a lot.

They approached quite a number of people to get a partner: they never got one. They didn't get one here, they didn't get one in Europe. One interesting thing is this: they took it up with General Motors, and since I knew the head of research of General Motors, I took it up with him. I got a letter back from him which said, 1) we don't think this is a better engine than the one we now have. 2) Even if this were a better engine, we would not be interested in it. Now, that was in writing. I've never shown it to anybody because I didn't want to get the chap in trouble, and I still don't. But when a vice president of General Motors can write a letter like that, something is decidedly wrong. [EH to VB: WHAT APPROXIMATE DATES ARE WE TALKING ABOUT HERE?] [VB to EH: LAST FEW YEARS. INVENTIONS MOSTLY MADE WHILE I WAS WITH CIW.]

The automobile companies have experimented a bit; General Motors put a free piston engine in a car, but they merely took a French engine, stuck it in the automobile and ran it around. They didn't modify it to any real extent. Chrysler's put some gas turbines in cars, and has even put a few of them out for people to use. I don't think either one has the slightest intention of doing anything really radical in the engine field, and the reason is just as I stated.

- 1) STEWART WARNER
- 2) TURN DOWM BY GM
- 3) THE AUTOMOBILE COMPANIES AND NEW ENGINES

Why should they, when they can sell all the automobiles they want to and can practically dictate the price -- except for the pressure of European competition. [X-REF BACK TO P. 229 AND FORWARD TO 497-498]

Of course there may be European companies that could undertake the development of a new engine, but it would cost very many millions of dollars to introduce it, develop it, get the bugs out of it, put it into production, and so on. I don't think European companies are in the position to take a chance of that sort. The American companies are, but they won't do it. The net result is that we'll probably continue to drive the same old engines.

I fully agree that we're in the same sort of situation as far as the development of turbojets and straight jet aircraft engines. We've lagged. We're not lagging today, but we did lag for a long time. However, there is one thing to be said about this on the other side, and that's this: toward the end of the war, the British, on the basis of Frank Whittle's work and so forth, started some very intensive development of jet aircraft. We talked about it in this country, and we were pretty well agreed that this was not for us. The British needed the fast jet aircraft far more than we did, and we were pretty busy.

- 1) THE AUTOMOBILE COMPANIES AND NEW ENGINES
- 2) POST WWII
- 3) BRITISH DEVELOP JET AIRCRAFT FOR THEIR NEEDS

[We had a committee of NACA that worked on the jet engine problem. Chairman was Durant. They did not as I remember urge heavy development here, but I haven't seen their report for a long time. Incidentally, when I recommended Durant's reappointment to NACA, the President, FDR, objected that he was too old, but I convinced FDR that he wasn't. Durant was active until about age 90 I believe, a grand old man.

[If we want intimate history of NACA we can get it from John Victory, now living near the Air Force Academy. A year or two ago he was trying to write a history of NACA, and was having trouble getting at the old records.] [END WRITTEN COMMENT]

Now this isn't the whole story; there was some British development before the war, of course, when we might have collaborated with them, when we might have done a great deal. I think without doubt, our companies in this country were backward in getting into this whole field. Still it is true that there was a period when the British were very anxious to get jet interceptors, very high-speed, when that problem was primarily theirs and not ours, because we were not in the position of having enemy bombers come over our cities. [REF. FOR EH. CHECK FORTUNE, YEAR 1947 RE WHITTLE & JETS INC.]

- 1) NACA & DURANT & FDR
- 2) POST WWII
- 3) BRITISH DEVELOP JET AIRCRAFT FOR THEIR NEEDS

Question 68: European-trained Minds Supply Most  
of American "fundamental knowledge"?

And Question 68 goes right along on this. Of course when I said that we can't count on ravaged Europe as a source of fundamental knowledge, I had no idea that Europe could recover with the speed it did. Still today, we are holding our own, and in fact I think leading in almost every branch of science. An interesting field is the field of biology where we've done a very great deal. It's not the spectacular stuff that gets into the papers; it's the kind of thing not easily understood by the public. We've done some magnificent work in this field, and very fundamental work, and I think we lead the world here. Russia has done very little indeed in good biology, principally I suppose on account of the fact that they've had the Lysenko business.

If you want one example, the whole idea of transduction was developed in this country, and several people were involved; I can give you the name of the man principally responsible if it comes back to me in a minute. [EH to VB: PLEASE CUDGEL FOR THE NAME.] [VB to EH: THE LAND-SOMETHING [?] EFFECT. I CAN GET IT FROM ABELSON IF YOU WANT IT.] Transduction is one of the most interesting things there is. If you have a phage, that is, a virus, which preys on certain

- 1) U.S. LEADS IN ALL BRANCHES OF SCIENCE
- 2) BIOLOGY -- US VS. RUSSIA
- 3) TRANSDUCTION

bacteria, you now perform the following experiment:

you develop two strains of the bacteria, one of which has a striking characteristic not present in the other.

For example, one strain may be resistant to streptomycin, and the other one not. All right. Now you let the

virus prey on the one that is resistant to streptomycin,

and after it's done that for a while, you transfer it

to the other colony of bacteria, being careful that

you've transferred nothing but the virus. The virus

proceeds to prey on the new crop of bacteria presented

to it. After this has gone on for a while, you proceed

with some tests, and you find that your second batch

of bacteria has acquired a resistance to streptomycin.

This has been acquired; incorporated in the genetic

system, so that it is inherited by the bacteria, and

the bacteria strain has permanently acquired this new

characteristic.

Here is the inheritance of an acquired characteristic, a thing which the biologists have stated didactically for years was impossible. It's not the kind of inherited characteristic one ordinarily thinks of, but it's an acquired characteristic, nevertheless.

This is a very striking thing too, because it can now be shown that the virus actually transports a piece of a chromosome from one bacterium to another.

1) U.S. SUPREMACY  
IN SCIENCE

2) TRANSDUCTION

This has led to some speculation on the role of virus in cancer, and so on. I mention it here simply to show that in this particular field, we are indeed doing fundamental work of a very high order.

[I had a theory on the role of the virus in cancer, perhaps 15 years ago, and sprung it on various people working in the field, but did not publish it. Even now the role has not been proved. When it is, it probably will not be my theory -- which was in any case probably entertained by numerous workers quite independently.] [END WRITTEN COMMENT]

Of course you're right that one of the things that attracts the British scientists over here is the salary scale, and also the fact that they can live in California, all over the United States. It's also true that among the people working on fundamental science in this country you will find every kind of individual you can imagine: old line Puritans, whose forebears came to this country way back in the 17th century; Italians whose parents came here three generations ago; and chaps just off the boat. We have every variety.

There is in science no prejudice to prevent this splendid assortment. In fact, if there's any prejudice, it's the other way. So, if you take the list of names of the faculty at MIT, for example, you'll find everything, including Chinese. [EH to VB:

- 1) U.S. SUPREMACY  
IN SCIENCE
- 2) TRANSDUCTION
- 3) U.S. SCIENCE IS  
NON-PREJUDICED

Reel 5-A  
Page 309

N.B. WE MUST MAKE THIS BETTER; MORE INCLUSIVE.]

(Been quite a long time when a full Professor of Electrical Engineering at MIT, who is a Chinese, and a very nice fellow. I met him just a few days ago and had a nice chat with him.) We are becoming very internationally minded in our science and in our universities, and this is all to the good.

[I wonder whether anyone, perhaps the National Research Council, may have made a census of American Science, showing national origins, dates of citizenship, etc.] [END WRITTEN COMMENT]

1) U.S. SCIENCE IS  
NON-PREJUDICED

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Question 69: America vs. Europe as Intellectual Centers  
....I.I. Rabi and Manny Piore Remarks....

I think Isadore Rabi's comment was undoubtedly correct. Without much doubt, right after the war Europe was in a heck of a mess; they didn't have much time, or anything else, to devote to fundamental science. They've come back a great deal, and today, it would be very hard to make a comparison on the basis of quality. There's no doubt that on the basis of quantity, we have far more scientists than all of Europe combined.

Now about Manny Piore's comments: I don't think you can get the thing into numerical terms. I think we have in this country today, in fundamental science, in any field that you want to name, our full share, and perhaps more, of the very top people, a good group backing them up and, of course, far more individuals engaged one way or another than anywhere else. I think this is true in all of the science in which we've been deeply interested. I think it's particularly true in the field of biology.

- 1) U.S. VS. EUROPE IN  
QUANTITY AND QUALITY  
OF SCIENTISTS
- 2) ISADORE RABI

Question 70: \$50,000 Grants for \$100 ideas.

I've said in a good many places, and I've said it to Congressional committees -- oh, fairly recently -- that I think we're pouring too much money into research today. When you pour in too much, you're bound to support the mediocre. We're doing a great deal of it, and we're wasting a good deal of money. Of course also I think we're wasting a good deal of money by reason of our childish enthusiasm for space flight. But that's another story. [EH to EH: WHERE TOLD? X-REF BACK TO P. 259 AND FORWARD TO P. 357.]

Way back, right after the war, when I was head of the Research and Development Board, in the Department of Defense, I held the appropriation for research and development of the armed services down to \$800 million a year. [X-REF FORWARD TO P. 338] I didn't do it with any support from Forrestal, I did it because I worked closely with Jim Webb, [X-REF BACK TO P. 180] who was then Director of the Bureau of the Budget. This caused quite a howl, because the admirals and generals I sat with thought I ought to be an advocate for more and more money for more and more military research. But I took the point of view with them, and with the budget, that if we went beyond that figure, we would begin to run out of skilled personnel, and we'd begin to support mediocre things.

- 1) GRANTS & SUPPORTING  
THE MEDIOCRE
- 2) FLASHBACK -- POST  
WWII AND OSRD

Since that time, the number of scientists and engineers, or applied scientists, in this country has increased greatly. Also, programs have reached the point where they need a lot more money for hardware -- for such things as atom-smashers, and space vehicles and so forth. So that it is quite right that the amount of money spent should increase -- and increase by significant amounts. On the other hand, I think the amount of increase has been unreasonable, and that we are today spending so much government money on research that we're doing two things: first, we're supporting the mediocre; second, we're making it very hard indeed for industry to get good men; hence we are to that extent holding back good industrial research. But I could talk on this forever, and I've been testifying enough on it.

[EH to VB: TALK SOME MORE. THIS IS A BURNING ISSUE.]

- 1) GRANTS & SUPPORTING  
THE MEDIOCRE
- 2) HOLDING BACK  
INDUSTRIAL RESEARCH

\* \* \*

Question 71: Science and the Humanities, Teaching of.  
Remarks of Barzun and Quiller-Couch

As you know, I believe in a reasonable balance between the science and the humanities, not only in teaching in the schools and the colleges, but also throughout life, in all of study. One of the principal places where I think the unbalance is made is in the medical schools, as I've mentioned before. A chap [X-REF BACK TO P. 311] going to a liberal arts college, gets a good husky dose of humanities, and then, after he gets into medical school, doesn't follow up. The gap is likely to become permanent. I think this is a great misfortune.

On the whole problem, which I could talk on for years, [EH to VB: ANOTHER INVITATION TO EXPANSION], I suppose, we have to remember some of the background which accounts, I think, for the fact that people get so stirred up over it.

[VB to EH: Well, I'll expand to the extent of bringing in one more point.

[The engineer deals with things and men, and in college should study both. On the latter, he gets a dose of economics, perhaps some psychology, hopefully some really good history, etc. But when he gets out into practice as a young employee he is likely to have to do almost wholly with things -- doing detailed

- 1) BALANCE BETWEEN SCIENCE AND THE HUMANITIES
- 2) REPEAT IMBALANCE FOR MEDICAL STUDENT

design, running a piece of production, etc. He doesn't for a long time present a report to the Board, or come to deal with the relations of the company with government, etc. The really keen chaps sometimes get so enamored with rapidly expanding techniques that they lose nearly all touch with problems of organization. Others get so deep into political aspirations in the company organization that they don't keep up technically. It is a rare chap who holds a proper balance. He is likely to go far.

[But companies, in their programs of continuing education for their young engineers, are very likely to be unbalanced also.] [END WRITTEN COMMENT]

For one thing, in SEF I was talking about the social sciences. We have to remember that there were no social sciences worthy of the name not so long ago. It's only recently that they've gotten into a form where they can be studied in a sensible manner. [EH to VB: CAN THEY, EVEN NOW? WHO HAVE YOU BEEN READING?] [VB to EH: THE ANSWER HERE IS THAT THEY NOW CAN BE, BUT SELDOM ARE.]

Their newness militates against their being in curricula in colleges as much as they might have been otherwise.

Another thing I think is very important in this connection: what do colleges teach? Well, the curriculum is selected by the faculty, and the faculty puts into

- 1) COLLEGE EDUCATION OF ENGINEERS
- 2) SOCIAL SCIENCES HAVE TAKEN FORM RECENTLY

Reel 5-A and 5-B  
Page 312-B

the curriculum the things they can teach. Faculty members get old, and the older faculty members are very likely to dominate their college. So, we get a curriculum with lots of emphasis on Latin and what have you, and very little emphasis indeed on some of the more interesting aspects of science. Now I think I'd better turn this reel over.

- 1) CURRICULUM AND  
AGING FACULTIES
- 2) LATIN & IN BRITAIN  
THE CLASSICS

\* \* \*

One hears a great many arguments about why Latin is such a fine study: it develops a logical mind; it enables one to study other languages effectively. I think all of these arguments are pretty superficial. If one wants to develop a logical mind, he'd better study logic. If he wants to learn other languages, he'd better get at it and study them when he's a kid; that's the easiest way to learn them. I think the argument comes about largely because there are a good many teachers still around in the colleges, and particularly in the secondary schools, and particularly in Britain, no doubt, who couldn't possibly teach anything else except Latin, and they have to rationalize it and justify it. The same thing can be said pretty largely of the classics.

[EH to VB: Your junior partner doesn't agree at all! The 'logical mind' argument is no good -- But the study of Latin tells you a lot about English. Puzzling out Latin is also good practice for the later puzzling out of equations. Latin would have saved you from the militate/mitigate slip on P. 312!] [VB to EH: NOT MY ERROR!]

1) LATIN & IN BRITAIN  
THE CLASSICS

[VB to EH: I don't say the study of Latin does not confer a benefit (although I never studied it, haven't felt any handicap as a result, and know the difference between militate and mitigate.) I merely say that many a youth is caused to sweat over it to an extent that is unwarranted by its true value to him.

[I have long felt a handicap by reason of the fact that I had no instruction whatever in them that was worth a damn. The only course in English literature I had was taught by a hack, and inspired negatively; probably my most inspiring course was in non-Euclidean geometry.

[Part of my attitude toward classic study no doubt comes from the fact that I grew up near Boston and was not a Brahmin.] [END WRITTEN COMMENT]

When we come to the classics, however, there is another thing that we have to keep in mind. For a long time, Britain was governed by a select group

with the old school ties, playing into one another's hands; a privileged group, it's true. A knowledge of the classics was the shibboleth that admitted a man to the group. If a chap threw in a Latin phrase or two, or if he referred to some episode of a Greek goddess, then it was known to the crowd that he belonged. It was a very convenient way of defining the group. It was a group of privilege, certainly. Also we have to say that if the group had not existed, England would probably have been in a sorry mess. For it was utterly essential that the democratic process, or the parliamentary system of government, be modified to some extent by a party of privilege in order to make it work over many years. It did work, and it probably saved Britain from difficulty.

Now this is not to say, of course, that all the privileged group were altruistic in their approach; they most certainly were not. It's not to say that they were all bright chaps; Oxford and Cambridge graduated many a dumbbell, and were set up to do so. It was not a group that was rich, essentially. Many of them were, but this was not the criterion. Nor was it a matter of titles, although titles played a great part in it. It was rather a group that was held together by reason of common interests in governing the country, playing into one another's hands in order to do so. The classics were

1) REPEAT OF BRITISH  
DEMOCRACY & THE ROLE  
OF THE CLASSICS

the common measure of membership. When one looks back and sees that the classics had this unique position, it's certainly not strange that they were regarded with great respect and perpetuated in teaching far beyond the time when they were really of service. Yet they served a purpose even after their political purpose was ended.

Why do we study a subject? As I've said many times, to make a fuller life, in the sense of a life more competent to secure success in a complex world, and also in the sense of making possible a life of satisfaction and enjoyment. No doubt the classics contributed to the second as well as to the first objective. For, indeed, it is a pleasant thing to trace back and read what some of the old Greeks wrote in their moments of ease, and so on. One can find in the classics great nuggets that are fascinating, and one can marvel that a civilization as far back as that could produce such extraordinary men and so many of them. But one can also find similar inspiration in all sorts of ways. The man who gets his inspiration out of the classics and never out of the current scene of science is missing a great deal, even from the standpoint of just finding intellectual satisfaction in life.

1) DEFENSE OF THE  
CLASSICS -- BUT  
NOT TO EXCLUSION  
OF SCIENCE

Now we come to Brother Barzun. I never read of his stuff. His story that science and technology are eating up the humanities just simply is not true. I think the best way to show that it's not true, is to take the case of the curriculum at MIT, for MIT is undoubtedly the greatest university in the world centered about science and technology. The trend at MIT has been in the direction of increased emphasis on the humanities. If there's any place in the world where science and technology might crowd out the humanities, it would be here. The contrary has happened, and it has happened at the instance of the faculty -- a faculty made up of scientists and technologists to a large majority. They have insisted that the balance be turned and that the undergraduate get more in the humanities than was true in their day. I believe it is true that today the man who goes to MIT and takes a degree in engineering, takes as a part of his regular course, more in the humanities than a chap who goes to a small liberal arts college, for example, and majors in chemistry.

This is an extraordinary thing, and it's a very hopeful sign. But it should be emphasized that these humanities that are thus studied, are not the humanities in the old sense. They are not designed to <sup>give</sup> a man a polish so that he can mix with an intellectual crowd and be accepted as an erudite individual. They are

- 1) BARZUN
- 2) INCREASING ROLE OF  
THE HUMANITIES AT  
MIT

designed so that the youngster who studies may learn something about men as well as about things. Hence there is a great deal of economics, psychology, and all that sort of thing, and in addition, of course, language and literature and history. The point of all of this is that it is modern liberal arts, modern humanities, not the old motheaten stuff.

- 1) MODERN HUMANITIES
- 2) NEW TEACHING AIDS

For example, in the teaching of modern languages today, every artificial aid possible is used. The teaching is far more effective, in terms of the number of man-hours necessary to acquire reasonable competence, than it was years ago. Of course also we have far better economics today than we had then. When I went to college, I took a course in economics. It was about the stalest, stuffiest thing I ever got into. I don't think the chap who was teaching it really knew much about the world; he merely knew about the things that were in textbooks on economics, and which had been passed from one author to another until they'd become accepted merely because of their repetition. His stuff was dead as it could possibly be. There's nothing of that sort today. Economists may differ -- and they certainly do differ plenty -- but when they discuss, you can be sure that the argument is going to reach deep, and that the statistical evidence presented will be well presented. There will be no bad mathematics involved.

Another thing that's come in: all of the sciences are becoming steadily more definite and more mathematical. In biology, for example, in genetics, there is some excellent work by Dobchansky [recently given the science medal by LBJ], Sewell Wright and others, [EH to VB: NAMES?] using the probability theory and that sort of thing -- statistical theory -- on the trend of a population under mutations, and everything that's involved in evolution. This is mathematical in the extreme at times, and it is excellent.

In economics, today, we have something fascinating: the digital machine takes a system, analyzes it, and predicts its performance. It does this with an electrical network when it's given the connections of the network and the constants involved. It does it also with a business system -- given the interactions between the parts of a company: purchase, sales, manufacturing and so forth -- and given the constants in terms of time lag on a sale, the time to go into inventory and come out, and all that sort of thing. Given that data, the digital machine will predict the performance of that system, and in so doing, it will aid the managers in improving their system.

- 1) SCIENCES BECOMING MORE MATHEMATICAL
- 2) ECONOMICS & THE DIGITAL MACHINE

The machine can do one more thing: it can go back into history, and it can take a national situation, and put in all the economic factors with their definitions that can be assembled -- the constants in terms of increase in population, mobility of population, and so on -- and then it can be made to predict. If this were done for a date, say 1900, it could predict what would happen in 1910. Then, given the data for 1910, it can predict for 1920. Here is the point: having done all this, the departure between what it predicted and what actually happened shows that something was lacking, or something was incorrectly stated. The economic theory used in setting up the problem may now be modified, and the thing tried again. When we get a match, or as close a match as can be expected, then we can have some confidence in the economic theories as they were outlined. I believe that this is going to make a great difference in economics in the future, because it's going to give a method of test in an area where test is hard to get.

Well, coming back to this guy Barzun. My pet peeve, as you know, is C. P. Snow. I haven't any doubt that Snow wrote what he wrote about the two cultures simply for the sake of trying to sell his books, and it probably worked. I suspect that Barzun did somewhat the same, although I haven't read his stuff. We have

- 1) ECONOMICS & THE DIGITAL MACHINE
- 2) C.P. SNOW & THE TWO CULTURES

one more point here: art is not confined to the humanities. In science there is an art, and without the art, science is likely to be pretty barren. The young microbiologist attempts to find out how a particular strain of a bacteria can be modified by mutations in order to produce a new strain of desired characteristics; or, in a medical search, tries to take a virus which is highly deadly, and modify it so that it can be inserted without harm into a human patient, and still cause the creation of antibodies to protect that patient against a disease.

[This reminds me of two things I have seen recently. One, an article in Science, in late March I think and which I think I brought to your attention, by a chap who points out the tendency of species to develop means for limiting their growth before they come to the point of malnutrition by pressure on the food supply.

[Another from the National Institute of Health. They encapsule a live virus of the respiratory tube, so that it becomes freed only when it gets to the intestine. There it can react with tissue, but it cannot produce the respiratory disease. It does, however, produce the antibodies against it, and thus protect. They seem to have proved this rather conclusively on one virus. This may well herald the beginning of the end of the common cold.] [END WRITTEN COMMENT]

- 1) THE ART IN SCIENCE
- 2) RECENT MICROBIOLOGY

The man doing this is not following textbooks and formulas, or doing routine experimentation. He also has an art, as much of an art as the artist who paints a picture. For he has to judge very subtle things; guess on the balance of evidence; try hunches; and the ingenuity and the skill he uses is comparable to the skill used by a musician who is writing a concerto. The emotional aspect may be different, for he is looking for a very practical result, not one whose aim is to be emotionally stirring. Still, of course, if he's trying to make a virus cure a disease, there is an emotional stir in that, if he ever thinks of the youngsters he may save from a painful death or the like. Merely because he is trying to do a practical thing does not mean that the art is absent.

In every field of science and its application, with the most capable individuals, there is art as well as science; just as, in the humanities, no matter what the artistic field, there is always a technique back of it. There is a technique in painting, or behind painting, that is distinct from the art of painting. So with music, so with all literature and everything else. The technique is not the art, of course, but the technique is necessary to the best performance of the art.

I think some of the modern painters probably dodge this question. I like some of the modern paintings

- 1) THE ART IN SCIENCE
- 2) TECHNIQUE IN THE HUMANITIES

Reel 5-B  
Page 321

I see very much indeed; probably one in 20. But I have a feeling that a great many modern paintings are painted by chaps who discovered after a time that they really did not have the technique, that they never could acquire it well, so they turned to a form in which the technique could not be easily questioned. Of course there's also no doubt that in modern painting there's a bit of a racket going on, fed by those who don't dare to say what they think. But this is off the point. The real point here is that the humanities and science complement one another; they merge into one another. The study of both, the practice of both, is necessary to a successful life in a practical way and also in the way of deriving satisfaction therefrom.

- 1) MODERN PAINTING
- 2) HUMANITIES & SCIENCE  
COMPLEMENT EACH OTHER

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Question 72: The Upcoming Educational Traffic Jam  
...National Merit Scholarships...The  
Financing of Higher Education in Science

We're getting more of a deficit in engineers than we are in trained scientists, and one of the reasons for this of course is the use of words. During the war, we talked on purpose of the Office of Scientific Research and Development. [X-REF BACK TO P. 199] All of our personnel were scientists, and when we accomplished something, it was a scientific accomplishment. Now we did this for the purpose of better relations with the military, but the trend continued, because of the journalists after the war, who had to speak of everything as "science". Take for example a thing like this: we shot a missile at Venus to take some measurements. (Incidentally, it didn't accomplish a great deal.) The papers told about it and said this was a great scientific achievement. It was no such thing. It was a great engineering achievement. One of the greatest engineering achievements was putting a satellite into orbit for communications purposes. There wasn't any new science, basic science, involved in doing this job. That was developed long ago. All the business of computing trajectories and so on, was as old as Newton or older

- 1) WHY THE EMPHASIS ON SCIENCE
- 2) SCIENTIFIC ACHIEVEMENTS OFTEN ENGINEERING FEATS

yet. By then all the parts were in existence. There was some applied science, if you please, in improving some of the parts, but the job was 95% engineering -- systems engineering -- aimed at securing reliability, of getting things into small compass, of making sure there was a test system which could detect defects and so on. Excellent engineering -- but engineering, not science.

Youngsters today, by and large, have been hypnotized by the word science. They don't know what engineering is, and they think it's something a little grubby, by comparison with the great role played by "scientists" in the world. As a result there hasn't been the rush into engineering that there has into science, and we'll have more difficulty getting engineers in the future than we will scientists. Now, of course, a scientist can become an engineer, just as an engineer can become a scientist, and this modifies the situation greatly.

During the war, the Radiation Laboratory was made up almost entirely of scientists. They even took in biologists and trained them in physics. But they were nearly all scientists. I used to argue with Lee du Bridge that they needed some more engineers among them. I couldn't get this across, because du Bridge,

- 1) SCIENCE VERSUS ENGINEERING
- 2) FLASHBACK WWII THE RADIATION LABS
- 3) LEE du BRIDGE

Karl Compton and Alfred Loomis had the bit in their teeth and were going places, and they didn't pay very much attention to my ideas as to how to run a laboratory.

At the end of the war, du Bridge said to me, "You see, we didn't need any engineers, as we proved." And I said, "Now, wait a minute, Lee -- you took in a bunch of scientists, and after doing primarily engineering work for several years, they became engineers, and some of them became very good engineers." That was actually the case. It doesn't take too long to get the other side of it, particularly when, as here, the engineering was not primarily the kind of engineering we have in peacetime. In peacetime the engineer deals with men a great deal. He deals with the men in his own organization, both above him and below him. When he becomes at all accomplished, he deals with boards of directors. He deals with customers, he deals with people who are buying his product, and so on. He has as much to do with men as with material. This is one of the reasons why he's likely to step on to a position of management.

During the war, and in the Radiation Laboratory, most of these things were absent. Its people did have some very interesting things to do in working with the military -- working with men in that sense. They also had a great deal to do with getting their equipment so

- 1) FLASHBACK WWII  
THE RADIATION LABS  
(Cont.)
- 2) THE ENGINEER IN  
PEACETIME

that it could be used by people, so that it would be accepted by them -- men in the ranks, men in the airplanes, and so on. But they didn't have the emphasis on the men side of it as much as an engineer normally has, and this made their transition somewhat easier than it otherwise would have been.

One of the things that's made Russian science move has undoubtedly been that all of Russia is combed for youngsters of real ability. When one is found, he is subsidized by the state through all of the education that he can usefully accomplish. We have come nowhere near that, although we have improved in the 20 years since the war. No longer is it true (except in medicine) that a youngster of real promise is barred by finances from the education he should have. I say, no longer is it true -- no longer is it a generality. We haven't yet done all we should, but we have made great progress. This has been due to all sorts of things: greater scholarship funds in the universities, government grants, the fellowship programs, and so on. Yes, I think we can do much more of this to advantage, and I particularly urge that we do it in such a way that we give the youngster his freedom. We're subsidizing through the doctorate, and we're subsidizing on post-doctorate study.

I am not too worried about the fact that there is going to be a pressure of population on the universities. I think we're probably educating, or trying to

- 1) WWII - THE RADIATION LABS & TRANSITION TO ENGINEERING
- 2) RUSSIA VS. U.S. IN EDUCATION & RECOGNITION OF ABILITY
- 3) EDUCATIONAL SUBSIDIES IN U.S.

educate, a greater fraction of the population through college today than is really sound. I think it does some harm to individuals at times, who start on this and can't make the grade. Any youngster of promise, of real intellectual capability, can rise through a crowd, and it won't make too much of a difference how much of a crowd it is. If there's subsidy for him, so that he's not cramped on his finances, he can go as far as it's worthwhile for him to go.

1) EDUCATING TOO MANY  
BUT ABILITY WILL SHOW

[EH to VB: THIS IS MUCH DIFFERENT IN TONE FROM PAGE 284, THIS REEL. I WISH YOU'D REFER BACK TO IT AND RECONCILE THIS PASSAGE AND THAT.]

[VB to EH: Yes, this whole thing needs careful reworking. Not worried about pressure on colleges. What I mean is that the pressure is to a great extent artificial, and that it won't do great harm if numbers in college are held down:- in fact if done on a proper basis it would be wise to decrease numbers in college.

[I'd also qualify the statement about young men of talent rising through the crowds. If the crowd is great it becomes harder for them to do so. Also when too many go to college, standards inevitably are pressed down. Then the keen youngster suffers.

[One of the great sins is for a college to admit large numbers and then throw a lot of them out.

MIT has improved its performance in this regard until I think it is excellent. I think dropout in freshman year is down to a few percent.] [END WRITTEN COMMENT]

This I think is the important thing because our progress in science, and indeed in engineering for that matter, doesn't depend so much upon numbers as it does upon leaders. Leaders in science who can inspire and lead great groups, and important programs of scientific research; leaders in engineering, who can become the heads of great corporations and guide them in a reasonable way in a highly technical world and so on. If we are easing the way, as we are, for the chaps who really have talent, ambition, good health, and a few more things like that, so that we are giving the opportunity to the fellows who are really going to the top, then I cease to worry about how many there are that are coming along, that are going to college because it's the thing to do, who really haven't got the ambition and the drive, or the intellectual capacities to really go to the top. For every really competent individual, who leads, who accomplishes, who creates, there always have to be many hewers of wood and drawers of water. [EH to VB: BEGS THE QUESTION, I THINK.]

- 1) SCIENCE & ENGINEERING  
REQUIRE LEADERS
- 2) ENCOURAGING TALENT &  
LEADERS IN EDUCATING

Question 73: Great Numbers Who Do Not Or Cannot  
Complete a College Education

I was much cheered up a while ago when I sat in on a conference at MIT on the question of reducing dropouts. I suppose the common conception of MIT is that it's a tough place, that they admit great numbers and throw half of them out. This is certainly not true. The instructions to the men in charge of admissions are to attempt not to accept any individual unless they are reasonably sure that he can qualify and graduate. They come pretty near this. I'm not sure that I can quote the figures accurately, but I believe that only about 2% of freshmen now drop out on account of inability to carry the work. This is apart from those who may drop out for family reasons, I judge. If it's down to 2%, it's pretty good, because certainly one in 50 may lose his ambition and drop out, not because he can't carry the work, but because he doesn't want to. If they've got it down to that figure, they're coming pretty close to the point where the system is to take in only men who can make the grade and then do the best possible job with them. Now, I don't know how it stands in other universities, but I'm inclined to believe that the figures are improving everywhere in this respect, and that this point of view is common to universities of higher standing.

1) MIT & DROPOUTS

We were saying a minute ago that there was getting to be great pressure on the universities, and that lots of young people wanted to get in who couldn't, because of the pressure. All of this increase in the number of applicants makes it still more possible to accept only those who will succeed. My interest, of course, is in the universities that are training the top groups. This doesn't mean, naturally, the largest ones, and it certainly doesn't mean that only these are doing a good job. You'll find a small college here and there which has had great success in producing outstanding individuals in one field, such as physics. What I'm interested in is the process by which the real leaders in science and engineering, and for that matter, in any other field, are being trained. The pressure of numbers is helping this situation rather than harming it to the extent that it makes it possible for these colleges to pick more readily the ones that they want, and the ones that they want are those who are going to be successful. Every time a college admits a man and then later must throw him out, it has a failure; the college now recognizes that it is its failure.

1) INCREASED APPLICA-  
TIONS MEAN HIGHER  
ADMISSION STANDARDS

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Question 74: Lifting of Security Regulations...The  
Rosenbergs, Alan May Nunn, Klaus Fuchs  
...The Meaning of Treason

I think that we can assume today, with the amount of scientific interchange that's going on, the amount of publication and so forth, that when a thing is known, discovered scientifically in one country, it [X-REF BACK TO P 279] won't be long before it's discovered in another country as well. In other words I think scientific secrecy today makes no sense whatever. Secrecy on military plans is a different thing. For example, we have war plans presumably for every contingency, and the Russians would like to know what we would do in certain eventualities. That involves real secrecy. On weapons, on the development of weapons, we have no secrecy and I don't think we can attain any. We publish so much, and it is so easy to find out how we are developing various things, that I don't think there's much in the secrecy on this either. There may be in a few special instances, but in general I don't think there is.

I think Rebecca West has treated the meaning of treason a lot better than I could; in fact she treats a lot of things much better than I can. In general I think we can look on the traitors as falling into a number of categories. One, of course, is the psychotic

- 1) SCIENTIFIC SECRECY  
MAKES NO SENSE TODAY  
-- SCIENTIFIC  
INTERCHANGE
- 2) NEED FOR SECRECY ON  
MILITARY PLANS
- 3) REBECCA WEST

individual, or the semi-psychotic, who simply thinks queerly, and would behave queerly in any society and under any conditions. In addition to this, I think a number of the Communists in this country, a lot of the extreme leftists, are motivated by the feeling that the present system of society is not a fair one, that there's a lot of special privilege in it, that there's a lot of inherited special privilege, as well as special privilege passed around by little clubs of one sort and another, and they resent this.

1) CAUSES OF TREASON

Of course there's something in this point of view. But we have far less special privilege today than we used to have. For one thing the enormous income and inheritance taxes have pretty well cancelled out an aristocracy of wealth -- that is, one that would extend over many generations. [EH to VB: ACTUAL STATISTICS ON THIS POINT ARE DISTINCTLY NOT CLEAR-CUT.] [VB to EH: I AGREE.] And for another thing, the rise in the standard of living has made privilege mean much less, because actually the difference in living conditions today between the man who's bringing in \$100,000 a year and the man that's bringing in \$10,000, is not very great. But the chap on the bottom of the pile doesn't think that way. He thinks that the cards are stacked against him, and stacked unfairly against him. This is the reason that he rebels

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against society generally, and if it happens to be that he can get in the position where he can pass some information, and get off his chest this feeling of trying to take a bit of revenge, he will do so.

Then of course there's the third class, who will just simply make a little money that way, and have no conscience and no principles. In addition, there are finally the guys that get trapped, who have had a bad history of some sort, criminal or social or sexual, and they can be subjected to blackmail pressure on that account. These all appear, probably, in cases of treason.

1) CAUSES OF TREASON  
(Continued)

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Question 75: The Roles of Science & Government - NSF

We all know that when government operates a complex affair, in general it is likely to operate it poorly. One of the best illustrations of this, in my opinion, is the difference between the post office and the telephone system, especially as far as the development of new methods is concerned. In general, government operates poorly. I got a good illustration of this in the field of research, when I first started with NACA, and discovered that the government-operated laboratory inherently cannot [X-REF BACK TO P 261] hold to the standards of a privately-operated laboratory. One reason for this of course is that in the government it's not a good idea to make mistakes, so people play safe. In the properly operated laboratories of industry or academic institutions, it is expected that men will make mistakes, and it is made clear that making a mistake is not going to interrupt a man's career, provided he profits from it, and provided it's the kind of mistake that any sane man might make on occasion. Also, we have two different types of tolerance of mediocrity, and of course under the Civil Service Regulations this becomes emphasized.

- 1) GOVERNMENT-OPERATED  
VS. PRIVATELY-  
OPERATED LABS
- 2) TOLERANCE FOR  
MEDIOCRITY

One shouldn't be too quick to judge on mediocrity. I got a good example of this one time. When Merle Tuve took over the management of the Department of Terrestrial Magnetism, there was one chap there who had been working almost alone on the mathematics of the magnetic fields of the earth, and he'd been working on it for years, struggling hard and conscientiously, and hadn't produced a doggone thing. Merle talked to me about what we were going to do with him. He just didn't seem to be justifying his existence, but we agreed that we wouldn't be hasty, and we waited. A year or two later, this fellow produced a startling result, and got elected to the National Academy on the basis of it. So you shouldn't be too quick to judge.

Now of course in society there are certain things which government has to do, and should do, in the public interest. The real problem is where to draw the line. In the field of electric power, government and industry are both operating. In general there is not a very great difference between the two groups in this particular field. The TVA, for example, is apparently not badly managed, as compared with the Commonwealth Edison.

The thing that motivates people here is a strange one. Our system of regulation of monopolies is odd. It does not put a proper premium on efficiency of management.

- 1) TOLERANCE FOR  
MEDIOCRITY AND  
"THE MAN IN  
TERRESTRIAL MAGNETISM"
- 2) GOVERNMENT & PRIVATE  
INDUSTRY IN ELECTRIC  
POWER
- 3) REGULATION OF  
MONOPOLIES

For regulation is based on the return of capital, and every public utility knows that if it begins to earn more on its capital than is generally accepted as reasonable, it will have its rates cut. Hence it's got a ceiling, and the incentive to improve performance is not great. This accounts for the fact that there's not a wide disparity between the two groups. [EH to VB: PHIL SPORN USED TO BURST WITH PRIDE BECAUSE HIS PLANTS HAD GREATER GRATES TO BUS-BARS EFFICIENCIES THAN ANY OTHERS. THIS DOESN'T CONTRADICT YOU BUT....] [VB to EH: I think the point here is that, after men get to a certain attainment in industry, they strive for excellence, not on account of financial reward, but because of pride, and that pride rests primarily on the opinions of their peers, in whose judgment they have confidence.

[My comments on government labs should not be so general that we overlook the fact that there are highly competent scientists in government labs. In all science the motivation of the really outstanding men is pride, defined in some form. But the government labs do accumulate a lot of deadwood.][END WRITTEN COMMENT]

Well, in passing, there are some places where an incentive is produced, so that if rates are cut, and at the same time earnings on capital increase, this is considered profit. This is not the general system, and the general system is pretty deadening.

- 1) REGULATION OF MONOPOLIES
- 2) PRIDE AS THE MOTIVATION IN SCIENCE

Why do men strive for efficiency of management anyway? It's not in order to make money for themselves, ordinarily, because the professional managers are on salary plus bonus plus retirement provisions. They have enough anyway, and efficiency is not going to increase this much. They do it out of pride. They do it because they pay great attention to the opinion of their professional colleagues. In government operations this to some extent also maintains efficiency.

Where do we stop? Naturally government operates in an area where things are not profitable, and hence government lends support either by subsidizing private industry or doing the job itself. In cases of monopoly, and in the cases of natural monopoly, we regulate. When we go beyond that, and government gets into business that is the natural field of private industry, we lose efficiency and it costs the public something. [EH to VB: I'D LIKE TO KNOW WHAT YOU MEAN BY NATURAL! YOU SOUND LIKE HERBERT SPENCER!] [VB to EH: Really using "natural" in two senses, and it's not a good word anyway. We have three situations: 1) activities which are inevitably governmental, notably the military; 2) activities which are preferably monopolistic because of the burden of duplication under competition, such as the post office or the telephone. These I believe are best operated by private enterprise under regulation, especially so if

- 1) STRIVING FOR EFFICIENCY
- 2) WHERE OUR GOVERNMENT SHOULD OPERATE -- "NATURALLY" --

the regulation is such as to preserve initiative.

3) Activities which come under neither of these. Here I think the profit motive works to public advantage -- in general, and in spite of cases which can be cited to the contrary.][END WRITTEN COMMENT]

Of course in order to examine this thing, we need to compare our system of private enterprise with the fully socialistic system. It's not much use to try to compare with Sweden; Sweden has both, and one affects the other. The Swedes have private industry and they have government-operated industry. We can compare with Russia, and I think anyone making the comparison would have no doubt, on the basis of the evidence available, that the Russians in their management are a lot less efficient than the private efforts here. [EH to VB: BUT OF COURSE IT DEPENDS ON THE AREA PICKED. I THINK YOU ADD TO U.S. COMPLACENCY IN SAYING THIS.]

[VB to EH: I wouldn't add to U.S. complacency for the world. Russia is getting better at it every day, and in doing so seems to be turning back to the profit motive a bit.

[A great advantage of the profit motive is that it decentralizes responsibility. Central planning can be very helpful (not that it always is) provided it doesn't try to get into detail. When it does get into

- 1) WHERE OUR GOVERNMENT SHOULD OPERATE (Cont)
- 2) PRIVATE ENTERPRISE VS. FULLY SOCIALISTIC SYSTEM

detail it delegates decisions to bureaucrats who have little interest in the outcome, or who, in case they are typical, have great skill in passing the buck.

[A bit back there is a word on incomes becoming less widespread in terms of meaning in an affluent society. Not in terms of dollars I feel sure. But the great dollar incomes are a pleasant way to collect taxes and support charitable causes. The recipient may dodge taxes well while he lives but bog [boy?] when he dies!][END WRITTEN COMMENT]

Now I don't mean to imply by this that our private enterprise management is perfect. It certainly isn't. We have a lot of stuffed shirts at the head of great enterprises. We have hangovers from the old system where the owner of a business, or his son or his grandson, is still running it and knows very little indeed about how to do so. We have absentee management in those cases. But in this country we have progressed quite far toward a system of professional management; that is, men trained to manage. Not necessarily men who've graduated from business schools, although this makes up a good part of the group; but also men who have started in other fields, and have continued to study and ponder and examine, and learn by their experience, and who have thus become good managers.

- 1) PRIVATE ENTERPRISE  
VS. FULLY SOCIALISTIC  
SYSTEM
- 2) PROFESSIONAL  
MANAGEMENT

The system of professional management is working. It is a strange system, for the private enterprise of course is not controlled by its stockholders in most cases; its board of directors is very likely to be built up as a self-perpetuating oligarchy, and in many cases largely chosen by management itself. The system therefore proceeds on its way undisturbed until there is a crisis of some sort, and a proxy fight, and somebody new takes over. Here too another thing operates. For not only does management have pride; so do the men on the board of directors, and the really powerful thing that corrects poor management is the feeling in the board of directors that when they go around to their clubs and mix with their colleagues, their colleagues are going to look askance at them because their operations are not in good shape. This is the motivating force in almost every case.

1) PROFESSIONAL  
MANAGEMENT  
& PRIDE

Now the professional managers today are a new class of professional men. They have not yet acquired all of the characteristics of a professional group, but they've acquired many of them. They are in general a far more competent group to manage than is the group which simply inherited its jobs and went ahead with a rule-of-thumb scheme that was good for their grandfathers.

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This is not a comment on science and government; 1) SCIENCE & GOVERNMENT  
the story on science and government will be a very long  
story. We'll probably get at it more or less piecemeal  
as we proceed. [X-REF FORWARD TO PP ]

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Question 76: The proposed Div. of National Defense  
...NSF...The 5 years after the war.

Of course there was a hiatus between the end of the war and before the NSF got moving, but this gap was filled to a very considerable extent by reason of the fact that the armed services went right ahead with their plans. For example, the naval group got their Office of Naval Research endorsed by Congress, and went on their way. They were making grants to universities, and there was a good deal of subsidy in this manner before the NSF got going.

Now in fact, we did recommend, way back, that the NSF have in it a division of national defense. I've pretty well changed my mind on this since those days. At that time I thought a bit of civilian work on national defense, controlled through a board that was not subject to the military, would serve to keep the military on their toes, and perhaps it would have. But also I've come to the conclusion that if this were done, it would have to be research and not development. The development of military equipment cannot be done except by thorough collaboration with military services, and I don't believe this can be achieved in time of peace.

- 1) PERIOD BETWEEN END OF WWII AND NSF
- 2) BUSH'S CHANGE OF ATTITUDE TO A DIVISION OF NATIONAL DEFENSE IN NSF

Neither do I believe that in time of peace you can get the really top men to serve in that kind of an affair. They'd much prefer securing grants to pursue something they're thoroughly interested in from its intellectual appeal, rather than plug away at the improvement of weapons and weapons systems. With these two things, I doubt whether a division of national defense would have been worthwhile. At any rate it dropped out of the picture, and I think it's probably just as well. [EH to VB: YET ONR KEEPS ON PRETTY WELL DOESN'T IT? AND WITH A CIVILIAN AT ITS HEAD?] [VB to EH: YES, BUT IN THE NAVY.] We have also to remember that in this interval the AEC was being formed, and in general the work on the atomic energy problem didn't stop completely by any manner of means, even before the AEC got moving. Of course, NACA was moving, and moving at a very much more rapid rate than it had been before the war. So the gap was not painful, at least.

You remember that it was at this time, or early in this time, that I was chairman of the Research and Development Board; first the joint board formed by the Army and Navy; and second, the board set up after unification by Act of Congress. At that time I on purpose held the military appropriations for research and development, down to about 800 million dollars a year. [X-REF BACK TO P. 310] I did it on the basis

- 1) PERIOD BETWEEN END OF WWII & NSF
- 2) AEC
- 3) NACA
- 4) REPEAT OF RESEARCH & DEVELOPMENT BOARD & FUNDS

Reel 5-B  
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that I didn't think more money than that could be spent wisely and intelligently. It also needs to be remembered in this connection that a large part of the research and development started during the war, did not, after the war, get into the range of hardware for a long time. It's hardware that takes the large money, not the research individuals. So while there was a gap before the Science Foundation got going, it was not, in my opinion, a serious one. We have to remember also that even with the NSF going at full speed, the money it handles is only a small fraction of the government subsidy of research and development at the present time.

1) REPEAT OF RESEARCH  
& DEVELOPMENT BOARD  
& FUNDS

\* \* \*

Question 77: National Science Board of NSF

Well, the board of the NSF is a rather strange affair. It's appointed by the President, and it's appointed of course to give representation geographically and all that sort of thing, and it has on it some weak sisters -- I don't know how many members -- a dozen or more. There have always been one or two strong men on the board, and they generally have enormous influence. For example, Det Bronk was a strong individual, and his influence with Congress and his influence in the board was excellent. There've been other men who have taken the leadership on that board as well. The important thing here, of course, is that the board recommends the appointment of the director, and the director then runs the show. This is far better than if the appointment of the director got into a political area, because the President is pretty much bound to follow the recommendations of the board, even if he makes them make two or three nominations from which he can choose. This part has worked all right.

This however reminds me of a story that's worth telling. After the Science Foundation legislation was passed, and Truman had agreed not to veto it, [X-REF BACK TO PP. 216, 217 & 702] he was about to appoint the board. At this time there was a dinner, an Armed Services Day

- 1) THE BOARD OF NSF
- 2) DET BRONK
- 3) APPOINTMENT OF DIRECTOR
- 4) BUSH & TRUMAN AT ARMED SERVICES DAY DINNER

dinner, and I was the master of ceremonies. I think probably the reason I was master of ceremonies was that they couldn't get anybody else to introduce Brother Johnson. [EH to VB: I DON'T RECOGNIZE LEE JOHNSON. PLEASE ENLIGHTEN.][VB to EH: OLD IRON PANTS. WASN'T HE THEN SECRETARY?] However that may be, I presided, and the President spoke. It was in the Mayflower, and I met the President at the entrance for automobiles, and conducted him in. Knowing the President's habits pretty well, I said to Mr. Truman, "Mr. President, I'm afraid this is going to be a dry dinner. Would you like a drink before dinner?" and he said, "I certainly would." We turned aside into a room, and left the Secret Service men outside, incidentally, and at the end of the room was a little table with a guy with a white hat on, and he and I walked up and we had a drink. He had his drink in his usual manner, which I've seen him use before; in other words, he took his whiskey neat, and followed it with a chaser later. So of course I did the same thing, hoping that I wouldn't choke when I tossed the neat whiskey down my throat. We had a drink or two, and then we proceeded in to the dinner.

During the dinner he sat on my right and Secretary Johnson was sitting beyond him, and apparently he talked to Johnson all he wanted to, so he talked to

1) BUSH & TRUMAN AT  
ARMED SERVICES DAY  
DINNER

me. The subject of the science board came up, and I said, "Mr. President, I wish you'd leave me off that board; I know my name is on the list but I wish you'd leave me off." He said, "Why?" and I said, "Well, I've been running about everything scientific during the war, and somewhat since, and I think people are getting tired or seeing this guy Bush run things around here. I think this outfit would do better if it had some new leadership. If you put me on the board, they'll elect me chairman, and I don't think that the body of scientists are going to like this continuation of one man in the top post. So I think you'd do better to let somebody else do it." Well, after a bit more talk, he agreed to leave me off the board. Then he said, "Well, Van, you're not looking for a job, are you?" And I said, "No, Mr. President, I'm not looking for a job." He said, "You can't say I went looking for this job that I'm in." And I said, "No, Mr. President, not the first time," which tickled him a bit. He poked me in the ribs, and he said, "Van you should be a politician. You have some of the instincts." I said, "Mr. President, what the hell'd you think I was doing around this town for five or six years?"

That was my relationship with Truman. Very pleasant, very informal, and on a basis which I enjoyed greatly. It continued, as I've said before, until later

- 1) APPOINTMENT OF BOARD AT NSF (Continued)
- 2) BUSH & TRUMAN AT ARMED SERVICES DAY DINNER (Continued)
- 3) BUSH FALLS FROM WHITE HOUSE FAVOR (TRUMAN)

on when the palace guard apparently thought that I was inconvenient, and I got poisoned. I never knew how.

[X-REF FORWARD TO PP. 461, 463, 464.] One time I was talking with Clint Anderson, Senator Anderson, and he said something about a thing I ought to take up with the President. [X-REF FORWARD TO PP 464-465.] I said, "Clint, I have no influence in the White House whatever." And he said, "What happened to you?" and I said, "I don't know, I guess I got in the way, and I got poisoned." He said, "You know, that happened to me once, and the President wouldn't talk to me for months, and I never did find out what it was all about." And I never did find out either, what it was all about. But that's what happened.

1) BUSH FALLS OUT OF  
FAVOR WITH TRUMAN

To continue the story, when Truman wanted a report on postwar science he made the chairman one of his staff, Steelman, who was some kind of a psychologist, I guess, [EH to VB: NOTE: HE CALLS HIMSELF A SOCIOLOGIST AND ECONOMIST. HOME STATE, ARKANSAS.][VB to EH: SO HE DOES.], in Carolina, and he appointed a committee, but Steelman did the work and wrote the report. When I was about to be appointed chairman, under the law, of the Research and Development Board, Forrestal asked me to take the post, and I said to him, "Jim, it's no good. The President's lost confidence in me; it wouldn't work." "Well," he said, "we'd better see the President."

We went to see Truman and Truman said, "I want you to become chairman of that board," and I said, "Mr. President, it's no good; you've evidently lost confidence in me; you'd better have a man that you have full confidence in." [X-REF BACK TO 179 & FORWARD TO 463-464.] He hit the roof, and used characteristic language for Truman, and said, "What makes you think so?" I said, "For example, when FDR wanted a report on postwar science he called on me. When you wanted a report, you called on John Steelman." "Yes," he said, "but you were on the committee." I said, "Sure I was on the committee and I never saw the report until it was in print." There was quite a silence after that. I don't think he'd realized anything of the sort. Then he gave me a long harangue to the effect that he had full confidence in me, he wanted me to do this job, he was going to lean on me just as much as he ever had, and so forth and so on. I said, "Very good, Mr. President, I'll take the job," and I did. After which he didn't call on me at all.

Now I don't know what came in to spoil that relationship. I probably never will know. I think it was just some fairy tale told around the White House staff and told to Truman.

I also think that Truman later found out that there was nothing in it, and this is the reason I think so. One day I went in to see Truman, and he was just

- 1) BUSH FALLS OUT OF FAVOR WITH TRUMAN
- 2) BUSH'S PHOTOGRAPH IN THE TRUMAN MUSEUM

signing some photographs to give to his friends, and I said, "Mr. President, while you're doing that, how about signing one for me?" He picked one right out there and gave it to me. Of course I wrote him a note and thanked him and put in one of the ones I was distributing.

- 1) BUSH'S PHOTOGRAPH  
IN THE TRUMAN MUSEUM
- 2) BUSH'S OPINION  
OF TRUMAN

A few years ago, one of my friends went into the museum where Truman's papers are being collected. I've never been there of course; I haven't been out to that part of the West, but I'd like to go there for this reason: when this friend went in, one of the first things he saw was my picture hanging on the wall. [X-REF FORWARD TO P. 465] Now it wasn't in a collection of pictures, according to him. It was sitting off by itself. I rather think that Truman found out later somehow that the fairy tale he'd accepted had no basis in fact. He didn't want to say so, I've never met him so that I could bring it up since those days, but I think when he was arranging things for his museum, he just stuck that picture up on the wall for that reason. This is pure surmise, but it may be so.

Finally on this let me say this: not only were my relations with Truman excellent, but I really had admiration for the man. I saw him act as a statesman on a number of occasions. I saw him make tough decisions, and I think the man was extraordinary. [X-REF FORWARD TO P. 461]

One time when Ike was considering running for the Presidency the first time, he wrote a letter, and it was published in the press. I had an office near him in the Pentagon at the time, so I dropped into his office the next morning, and told him, "Ike, I'm proud to know a man that could write as fine a letter as that." He said, "Well, sit down, and I'll tell you how I wrote it." And he did. He'd struggled over it for several days. We had a nice chat about it, and one thing he said was, "Now of course you know, Van, I never would be found running against my superior officer." We talked about Truman, and he made one remark that's stuck in my mind ever since. We shouldn't quote it, of course, without Ike's permission. He said, "Truman is the rare type of man who occasionally rises well above his source."

1) IKE'S OPINION  
OF TRUMAN

I think that characterizes Truman excellently. At times, with his language and his attitude and so forth, he reminded you of a ward politician. At times, without question, he was a great statesman. Undoubtedly in the course of answering these questions, I'll get to some incidents where he did just that. [X-REF BACK TO 271 AND FORWARD TO 462, 463, 730]

Well there's a little more tape left on this film, but I guess we'd better not be greedy, so I'll go to Question 78 on film 6.