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## Brief guide to the atomic age

Richard Martin Fagley

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*BRIEF GUIDE TO THE*  
**ATOMIC AGE**



Richard M. Fagley

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**The Atomic Age**

By  
Richard M. Fagley



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## About the Author

AFTER MR. FAGLEY graduated from Oberlin College in 1932 (with a Phi Beta Kappa key on his watch chain), he entered the Yale Divinity School, where, in addition to making a notable record as a student, he began his writing career. He is a member of about all the organizations one can think of whose purpose is to further world peace, and he has done much writing in that field. His scientific side interest enables him to understand better than most persons the meaning of atomic power.

At present he is on the staff of the Federal Council of Churches of Christ in America, serving as the Council's secretary of the Commission on a Just and Durable Peace.

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# *Brief Guide to* The Atomic Age

RICHARD M. FAGLEY

**J**ULY 16, 1945—that's one date to remember. It is probably the most important date for the past nineteen centuries, since the time when Jesus of Nazareth was nailed to a cross but triumphed over death, and a group of His disciples joined in the first Christian church. It is the date when you were plunged into a world so different from the one you have known that it will take you and the rest of us years just to discover the difference.

Maybe you were one of those who hoped that, when you got back from the wars, things would be the same as when you left. Of course, I hope as you do that you are finding the same beloved faces, the same home-cooked food, the same

familiar scenes that you've been dreaming about. But the world won't really be the same; it can't be. Something new has been added, something so tremendous that it may affect your life in a thousand different ways, although it may be some time before this new thing begins to make a difference you can see and feel. If you want to keep up with the new world in which you live, you will have to consider what happened on July 16, 1945.



***The Atomic Age came with a bang***

That was the day when a little group of scientists and soldiers who now wear



a question mark on their shoulder patch set off a fairly small bomb mounted on a steel tower in New Mexico's desert. The explosion dug a huge crater and heated the sand so hot that it melted; it lit up the sky brighter than noonday; it knocked down men five and a half miles away; it shook the earth over a great area. The steel tower went up in a puff of gas. That was the day when man first succeeded in imitating the sun. That was the day when scientists were first able to prove they could split atoms in a big way. That was the day when the Atomic Age was born.

Of course, other days have played a part in bringing in this new era, and a case might be made for one or another of them as the big day. There was the day in 1896 when Henri Becquerel in France discovered that the element uranium released enough atomic energy to make an impression on a photographic plate. This started the Curies on their search for radium. There was the day in 1905 when Albert Einstein, then in Germany, worked out a mathematical equa-

tion showing how mass and energy can be converted into each other, and what an amazing amount of energy is repre-



sented by a tiny atom so small that no microscope can see it. There was the day in 1919 when Ernest Rutherford, in England, succeeded in chipping the atom. Danish, French, Italian, German, Russian, British, and American scientists discovered new steps on the way to the atomic bomb. In 1939 Hahn and Strassman split the atom wide open with startling results. There were also August 6 and 8, 1945, when two bombs were dropped on Hiroshima and Nagasaki, revealing the meaning of atomic power in warfare. And



there may be other days when men discover how to slow down atomic explosions enough to put them to peacetime uses.

### ***Everything is made of atoms***

But July 16, 1945, is likely to remain the big day. That was when atomic power entered the stage of history in a dramatic way and began to change history itself. Every substance in the universe, so far as we know, is made up of these tiny atoms, each of which is equivalent to a large amount of energy. Some of them are quite simple; others are complicated and heavy. Each different "element"—such as hydrogen, iron, gold—has its own kind of atom. Chemical "compounds," such as water, are composed of "molecules" in which atoms of different elements are combined. (A molecule of water has two atoms of hydrogen and one of oxygen.) These atoms and molecules are the building blocks that form all substances. Until recently, it was supposed that atoms could not be divided—that is, they were not

thought to be made of anything smaller.

Man has gradually learned how to separate and combine the various substances to make nature serve his needs.



It began when the cave man made his most important discovery: how to make wood burn by rubbing sticks together or striking stones. This first discovery led step by step to the industrial civilization in which we live.

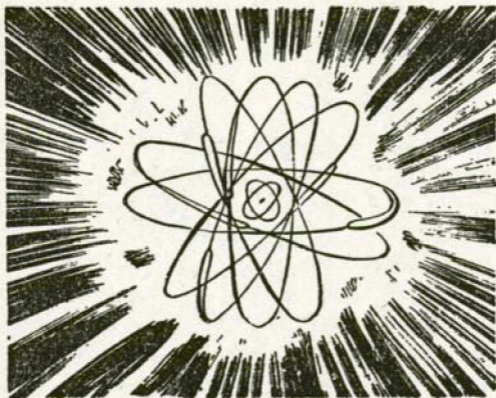
It took a long time before man learned the many uses of fire. At first he used it to keep himself warm, and he learned how to cook. But it took many thousands

of years before he learned how to melt copper ore and make better tools and weapons than his chipped or polished stone instruments. Six thousand years ago the Stone Age began to be succeeded by the Bronze Age; and then about a thousand years before Christ began the Iron Age, which lasted up until July 16, 1945.



Through all these long periods of time man has been separating and recombining atoms and molecules in various useful ways, but he hasn't tinkered before with the basic structure of the atom itself, except in a small way. Now he has suddenly succeeded in doing it. That is

why scientists regard this new development as the most important scientific discovery since man lit his first fire. That is why we now live in a new age, the Atomic Age.



***Atoms are small but mighty***

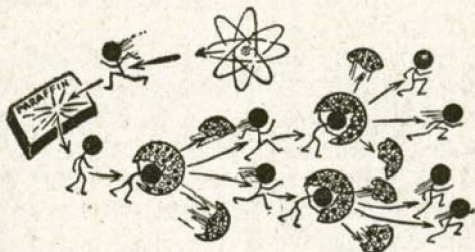
Let's look more closely at this mighty midget with which man is beginning to change the world. "Look" is hardly the word, since we can't see an atom but can only imagine it from the way it behaves.

It has been said that, if you blew up a drop of water until it was the size of the whole world, then a molecule of several atoms enlarged to the same degree would be the size of an orange. Yet the atom, this speck of concentrated power, is not a single object. Small though it is, it is composed of particles much smaller. It seems more like a solar system with a central sun, or "nucleus," with a positive electrical charge, surrounded by different particles like planets, called "electrons," carrying negative charges that equal and balance the charge on the nucleus. The nucleus itself is made up of "protons" and "neutrons." The protons carry the positive charge. The neutrons carry no charge, but are part of the weight of the atom. In the case of certain heavy elements, such as radium and uranium, some of the particles in the nucleus tend to fly off at great speed. These elements are "radio-active."

Einstein's equation had shown what an amazing amount of energy is associated with the atomic nucleus. Some of



this energy is set free in the radio-active to get at more of it. The problem was how to do it. They tried to do it arti-ficially, and naturally scientists have tried



cially by knocking protons and neutrons out of the nucleus—bombarding it with high-speed particles, such as other protons that they got from natural sources, for example radium, or from very ingenious mechanical devices, of which the cyclotron is one. But these particles are all charged with electricity; and since the atom nucleus is similarly charged, the “bullets” rarely got through to them. The problem was solved when they used neutrons for bullets, for they carry no

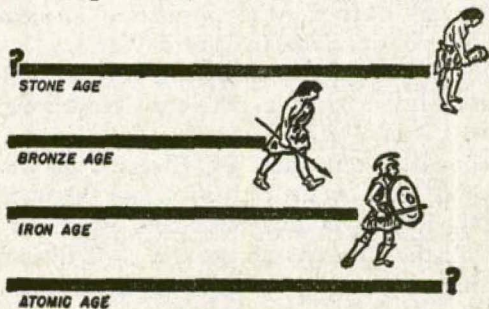


charges; and at last man was able to split the atom. Whenever an atom was split, a large amount of energy appeared.

**Science has at last learned how to use the power in the atom**

The bullet needed improvement, however. It went so fast that it might go through many atomic "solar systems" before it would hit the target and explode it. To get the maximum effect, scientists had to find "buffers," like paraffin or heavy water, to slow down the neutron bullet. That did it.

But billions upon billions of atoms had to be split to get a really powerful ex-



plosion. The neutron bullets, even when slowed down, wouldn't hit enough atoms at the same time to produce such a tremendous effect. Some forms of uranium provided the answer. When some of these atoms were hit by the neutrons, they not only broke up but they also gave off other neutrons that hit many additional atoms, thus starting a chain reaction, like grains of gunpowder exploding one another. Only this explosion was infinitely greater than the most potent TNT. The two bombs dropped on Japanese cities were still in the infant stage. If there is another war, the atomic bombs may exceed the present bombs as much as the blockbuster exceeds the grenades airmen dropped by hand in World War I.

So, for better or worse, we have crossed the threshold of a new era. How long will it last? The Stone Age lasted for a thousand centuries, the Bronze Age for more than twenty centuries, and the Iron Age for nearly thirty centuries. How long will the Atomic Age endure? It is fitting that the soldier specialists who worked

on the project wear a question mark on their shoulder patch.

**Atomic power makes possible a  
Buck Rogers war**

Let us look first at the military aspects of the problem. General H. H. Arnold, chief of the Army air forces, said at a press conference the other day that rockets more efficient and effective than the V-2's are coming along. Over a year ago, he said, bombs were being guided through television by a plane fifteen miles away. Already there are control devices for the rocket bombs in the experimental stage that will make them "home" simply by reaction to light, heat, or metal in the target. "Use these," he said, "with the atomic bombs and the new planes, and you get a Buck Rogers conception of war which is right on our threshold."

General Arnold went on to predict new atomic bombs "more destructive than the wildest nightmares of the imagination," and rockets so powerful and

be made on targets of a mile square or less, at any part of the world, from any guided so accurately that "exact hits can



part of the world." This could mean, he pointed out, that the major cities of a country might be destroyed overnight. He summarized his reactions in one sentence: "This thing is so terrible in its aspects that there may not be any more wars." Certainly, any sane person would say: "Amen!"

One thing seems clear. The atomic bomb has greatly limited the use of armies and navies. A few of the new

bombs would be enough to wipe out any fleet or military base—not necessarily by direct hits, but also by terrific concussion from not so near misses. As soon as other countries are able to develop atomic rockets, our own pre-atomic armaments will be out of date. The atomic bomb revolutionizes basic ideas of military theory.

Of course, scientists will attempt to devise defensive weapons against the atomic rocket. What these defenses will be like no one now knows. Some people may survive at the bottom of deep mines, if bombs do not land near enough to seal the exits or kill by concussion and intense heat. No experience with other weapons offers hope for more than a partially successful defense at best. And a partial defense against atomic rockets is not much better than no defense. As Major George Fielding Eliot has written: "The forces which man has now brought into play are forces which can be utterly destructive, so that no living thing may survive their loosing—if they are ever loosed in their ultimate power."



***An all-out atomic war may mean  
the end of civilization***

Sudden attack without warning, all-out attack with atomic rockets to destroy the manufacturing plants and launching sites of enemy countries, would be about the only hope of national survival in case of war. Yet, since all countries would have the same idea, they would all be working night and day to build secret launching sites and secret plants deep underground. Therefore no attack, unless it were big enough to wipe out a whole nation, would be powerful enough





to prevent terrible retaliation. If you carry this argument far enough, you would end up with every country trying to destroy the rest of the world to save itself. The result might be the end of the human race.

That prospect is the "something new" that the Atomic Age has added to military problems. The world can hardly expect to survive another war. It is possible that a few persons, in some out-of-the-way corner of the world, might live to repopulate the world and perhaps rebuild a more sensible society on the ruins of a lost civilization. Yet it is also possible that a bomb, more powerful than intended, would destroy all life. Then "this planet," as Major Eliot puts it, "would roll on, a blackened cinder, through the limitless night of inter-stellar space."

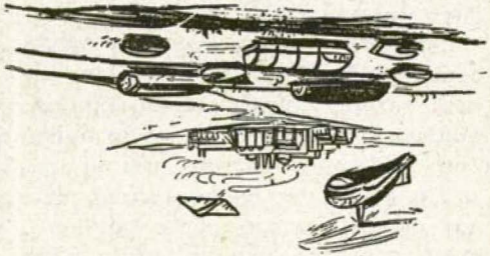
The duration of the Atomic Age, you see, is a real question. It might last only a few years, until the world committed hara-kiri. But let's look a moment at the constructive possibilities.

***But atomic power has good possibilities too***

The ancient Greeks knew little about the development of prehistoric man. So when they tried to explain man's knowledge of fire, they invented a myth to account for this wonderful discovery. Prometheus, they said, had taken pity on mankind, and had stolen fire from the sun and brought it to earth for the benefit of men. But the sun's rays, which melt the snows, change minerals into food for plants, and give our bodies health, are not caused by any *ordinary* fire. They are caused by atomic explosions basically like that of the atomic bomb. Fortunately, the sun is so vast and the explosions are kept enough in check to prevent the sun itself from blowing up in one gigantic explosion.

And now the same power that is in the sun has been brought to earth. If scientists can slow down the atomic explosions enough to put them to work (experts are very hopeful about this), if the raw materials that can be used in the process are not too limited (there is no

It would be nice to dream about the constructive possibilities; but unfortunately, until atomic power is made safe for mankind, the benefits will not amount to



The possibilities of the Atomic Age for both good and evil surpass imagination.

*What shall we do with the mighty atom?*

reason to suppose that they are), then mankind can have almost boundless energy to serve its material needs. Our present sources of power, coal, water, and oil would be but a drop in the bucket of our future supply of power. God has never permitted man to discover a secret of greater potential material benefit.

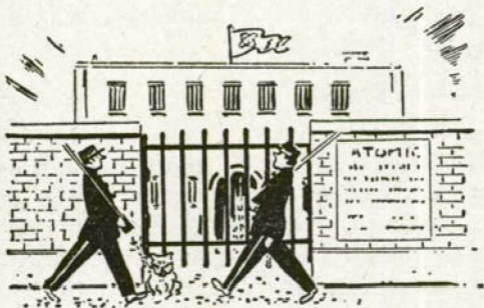
much. The main value in thinking about them is to strengthen our determination to choose life instead of death for ourselves and humanity.

How can this weapon of destruction be controlled so that it may become a tool of industrial progress? How can we make atomic power a blessing instead of a curse? That is the problem we face, government leaders and ordinary citizens alike. It is the biggest single social issue we face in the post-war world.

Right now the only known factories for making atomic bombs are in the United States. For the moment there can hardly be war, since no country or combination of countries without the bomb could take on one country possessing it.

But how long can we keep exclusive control? It was an international discovery, and Britain and Canada know all the essential facts. The Russians have long been working in this field. Experts have estimated that German scientists were only twelve months behind us in their research, and Japanese scientists were

also seeking the answer. How long can we keep the secret to ourselves? Sir James Chadwick, who was in charge of the British end of the project, gives the rest of



the world three to five years in which to learn to make atomic bombs. If in that very short time rival nations can begin arming themselves in this way, we shall stare disaster in the face. Is it hard to imagine the fear that would run riot throughout the world? Is it hard to foresee that governments would try to strike first with all the bombs possible, to prevent enemies from doing the same thing?



The fact that the bombs are so destructive would not prevent war, but would push nations into aggression. As Norman Cousins has pointed out in the *Saturday Review of Literature*, the more deadly the weapons, the more likely the outbreak of war.

***Shall we keep the secret?***

No matter how you look at it, the United States, Canada, and England simply do not dare to allow other countries to make a weapon that could utterly destroy them. Today they hold the power of life or death over all other countries. We the people and our governments must act quickly, before our monopoly has been broken, to prevent other countries from making the bomb for national armament.

Of course, these three countries or the United States alone could conceivably try to police the whole world. That would unite the world against them and might lead to other forms of warfare, such as deadly germ warfare. In any case,



international control mean? It means that, in return for agreement to place the atomic bomb under the United Nations, all other countries would agree to permit an international commission to inspect at all times all of their factories and laboratories where bombs might be made. It would probably mean that, for a while at least, all research in this field



this policy seems out of the question, since world domination is contrary to the present ideals of these people. That leaves only one alternative—international control now, before other nations develop the bomb, and while the United States, Canada, and England can still make the major decision. What does

and all experimental equipment would need to be brought under the control of the United Nations. Perhaps even the raw materials would need such control. Each country would have some assurance that it would not be destroyed, since the nations jointly would govern atomic power.

The *New York Herald Tribune* of August 26 puts the case well. We can use the bomb, it says, "to compel all other great states to develop bombs of their own, with the result that war would be reduced to levels of more appalling horror than it has so far reached." Or, it goes on, "we can use it, while we still have a monopoly, to compel all nations to internationalize the weapon, to put it under a genuinely international . . . authority, to establish international inspection of all uranium ores, mines, nuclear energy plants, all research in atomic physics." But, it adds, "even for that we have not too much time."

Would the plan work? Not certainly; it is not absolutely foolproof. But no

other arrangement seems to offer any hope of working at all. That is the tough dilemma we face as individuals, as a nation, and as a world. Yet international control has a chance to work; it can give us a little time to make it more certain; it can give us a push in the right direction.

***It is bombs versus brotherhood***

In the long run, our main hope lies in the ability of men everywhere to find and to practice a new spirit of human brotherhood. Unless this spirit can triumph over hate, prejudice, and fear, no political solution can be sure. Unless we understand quickly that the atomic bomb has made terribly more dangerous the old conflicts between nation and nation, race and race, capital and labor, the political controls will not have any sure foundation. We must actually practice the Golden Rule or face disaster. The churches have been saying this for nineteen centuries. This time it ought to be plain enough for everyone to see. The

atomic bomb is some punctuation mark!

What does our faith tell us? We know how Jesus offers men the choice between abundant life and spiritual death. We know how lightly at times we have taken his commandments. The teachings of the Bible have seemed to make little practical difference. Well, now it is clear that if we and the rest of mankind are to survive, we have to take them seriously. The love of God and man has become for all to see the most practical thing in the world, the one real hope even for our physical survival.

Dave Boone put it well in his column in the *New York Sun*: "It looks as if man had better start harnessing the forces of the Spirit, the powers of Holy Writ and the electrons of the Golden Rule and the Ten Commandments. The only 'atomic bombs' that will save mankind from now on are to be found there. . . . If we would only spend sums like \$2,000,000,000 to harness the forces of God's teachings what a break it would be for the human race. No uranium is needed as a medium for





reasons why the present danger is so great.

***Persons are as mighty as atoms***

Each of us has to make up his own mind on his personal responsibilities in this time of peril; no one else can do that for him. But let no one think that his responsibility is small or the job he can do unimportant. The atom seems insignificant, merely a unit of matter. Yet when that atom is linked with others in a chain reaction, it is powerful enough



to destroy the world. Just so, every individual person counts in molding public opinion, in shaping government policy,

in deciding world events. Each of us needs to act as if the whole responsibility were his own, for in one sense it is.

There are several things we can all resolve to do:

1. Hold tight to the idea of the United Nations Organization. Talk it up; don't let others talk it down. It is our big hope for substituting institutional co-operation in place of conflict.

2. Stand for fair play in the treatment of all persons in our population. There are a few hare-brained professional haters in our country, preaching intolerant doctrines. Some of them have quite a following. Don't be taken in by their false patriotism.

3. Among your friends you will doubtless find a few who jump to conclusions too quickly, or thoughtlessly express prejudice toward Jews, Negroes, Catholics, or other groups. A little tactful work on your part may help them take a fairer attitude.

4. We can practice in our own daily

life the principles of justice and good will that are at the center of Christian faith. We must find ways to give it expression in all community, national, and world relationships.

5. We can take an active part in helping the Christian churches, and all forward-looking community agencies and programs, to bring Christian principles in an effective way before all of the people everywhere, and thus to lay the foundations for a durable Atomic Age.

As a part of its educational program, the Young Men's Christian Association circulates and publishes books and pamphlets that will help individuals and groups develop for themselves an understanding of the problems of Christian personality and a Christian society, and will motivate *them to effective conduct and action.*

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